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MYCOLOGICAL WORK IN THE BERMUDA ISLANDS

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(WITH PLATE 18)

Before 1912 little attention had been given to the fungi of the Bermuda Islands, in fact it was often stated that there were no fungi to speak of in those Islands. Previous to this time twenty-four species had been reported by the Challenger Expedition and a few collected and described by Dr. Farlow, including *Puccinia Lantanae* which is common there on the leaves of *Lantana involucrata*.

In November 1912 the writer was asked to accompany Dr. N. L. Britton of the New York Botanical Garden on a collecting expedition to those islands. About two weeks were spent in Bermuda and a goodly collection of fungi brought home for study. In addition to these about 40 species collected by Dr. and Mrs. B. O. Dodge previous to our visit were turned over to us. In 1916 a list of about 120 species was published in the Memoirs of the New York Botanical Garden (**6**: 501–511) which was the first attempt, so far as we are aware, to compile a complete list of the fungi known in that region.

Professor H. H. Whetzel spent an entire year in Bermuda, 1921–1922, in the employ of the Bermudian Government, the time being devoted to problems in plant pathology and a continuation of the survey of the fungi. His work greatly extended our knowledge of the fungi and it is the intention to publish a

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complete list at some future time. During the past winter the writer had the privilege of accompanying Professor Whetzel on a second collecting expedition, sailing from New York on January 9 and arriving home on February 15, the entire time being devoted to the collection and study of the fungi. More than three hundred collections were brought home for study.

While it is too early to give a finished report on this material, preliminary studies made at the Experiment Station have revealed a number of very interesting forms. It is the intention of the collectors to make a detailed study of the collection reporting on them at intervals in short technical papers which will be published in MYCOLOGIA.

When this work is finally completed, our knowledge of the fungi of Bermuda will probably be as complete as that of any other group of islands in the American Tropics or Subtropics except possibly Porto Rico and the Virgin Islands on which a great deal more time has been spent. While the number of species in Bermuda will naturally be much smaller, it will doubtless be relatively as complete as that of those islands.

The predominating tree in Bermuda is the Bermuda cedar, *Juniperus bermudiana*, which is distributed throughout the islands. In exposed situations it is often low and stunted, while under more favorable conditions it becomes a good sized tree, with the branches much more spreading than those of our native red cedar. The largest tree on the islands measures about 5 feet in diameter. We were naturally interested in the fungi which grew on and appeared to be restricted to this endemic host, and secured a surprisingly large number, some of which may themselves be new and endemic species.

Bermuda is a most beautiful place to visit especially for the naturalist, the quiet, restful atmosphere being especially conducive to scientific research. The illustration accompanying this article shows a typical road in these islands with the endemic cedar on the right and the royal palm an imported species on the left.

THE RUSTS OF SOUTH AMERICA BASED ON THE HOLWAY COLLECTIONS—I [1]

H. S. Jackson

(With Plate 19)

The following is a report on the identification of the rusts collected in South America by Prof. E. W. D. Holway and Mary M. Holway. The collections were obtained on two excursions, the first of which made in 1919 and 1920 included Ecuador, Bolivia, Peru and Chile. The second trip was made in 1921 and 1922 to Brazil and Argentina.

This is the first of a series of papers on the same subject. The reports will take up the rusts by families of the host plants in the order as given in Engler and Prantl.

Included in this report are the rusts obtained on both trips occurring on the ferns, and monocotyledons. The rusts on *Carex* are omitted as it is found impossible at this time to report on them in a satisfactory manner. The rusts on Poaceae have already been reported by Dr. J. C. Arthur (Proc. Am. Phil. Soc. **44**: 131–223. 1925.)

The combined collections consist of 2049 numbers, most of which are rusts. A few represent smuts or other fungi and a somewhat larger number were collected for Phanerogamic specimens. There were included, in the report by Arthur on the grass rusts, 464 of the Holway numbers, distributed among 58 rust species. The present report records 109 collections representing 49 species of rusts on 71 hosts.

The writer takes pleasure in acknowledging his great indebtedness to Mrs. Holway who has made it possible for him to make this study and who has given generously of her time in arranging and caring for the collections, and also to Dr. J. Arthur Harris for many courtesies. Acknowledgment is also due Drs. P. C. Standley and E. P. Killip who have determined most of the hosts.

[1] Contribution from the Botanical Department of the Purdue University Agricultural Experiment Station.

SPECIES ON PTERIDOPHYTA

1. DESMELLA ANEIMIAE (P. Henn.) Sydow, Ann. Myc. **16**: 241. 1918.

Uredo Aneimiae P. Henn. Hedwigia **35**: 255. 1896.

Aneimia fulva (Cav.) Sw. Santa Anna, São Paulo, Brazil, May 28, 1922, *1900*.

Both uredinia and telia of this interesting rust are present in this collection.

2. PUCCINIA LYGODII (Hariot) Arth. Bull. Torrey Club **51**: 55. 1924.

Uredo Lygodii Hariot, Jour. de Bot. **14**: 117. 1900.

Dicaeoma Lygodii Arth. Bull. Torrey Club **51**: 55. 1924.

Lygodium volubile Sw. Rio de Janeiro, Brazil, Aug. 27, 1921, II, *1078*.

This is the third collection of this interesting species from South America. The type was collected at Pernambuco, Brazil, on *Lygodium* sp. Arthur (l.c.) reported it from near Bahia, Brazil, on *L. polymorphum* (Cav.) H.B.K.

3. UREDINOPSIS MACROSPERMA (Cooke) P. Magn. Hedwigia **43**: 122. 1904.

Uredo macrospermum Cooke, Grevillea **8**: 71. 1879.

Pteridium sp. Tijuca, Rio de Janeiro, Brazil, Aug. 19, 1921, II, *1059*.

This is the second collection recorded from South America; otherwise known only from Colombia.

SPECIES ON CYPERACEAE

4. PUCCINIA CYPERI Arth. Bot. Gaz. **16**: 226. 1891.

Dicaeoma Cyperi Kuntze, Rev. Gen. **3**[3]: 466. 1898.

Cyperus cayennensis (Lam.) Britton. São Caetano, São Paulo, Brazil, Feb. 22, 1922, II, *1583;* Villa Augusta, Guarulhos R. R., São Paulo, Brazil, Feb. 25, 1922, II, III, *1595*.

Cyperus ferax L. C. Rich. San Felipe, Sur Yungas, Bolivia, May 19, 1920, II, III, *622*.

Cyperus Haspan L. Rio de Janeiro, Brazil, Dec. 20, 1921, II, *1411*.

Cyperus lenticularis (Schrad.) Steud. Lapa, São Paulo, Brazil, Feb. 27, 1922, II, III, *1601*.

Cyperus Olfersianus Kunth. Bello Horizonte, Minas Geraes, Brazil, Nov. 30, 1921, II, *1348*.

Cyperus sp. El Chaco, Sur Yungas, Bolivia, May 25, 1920, II, *648;* Therezopolis, Rio de Janeiro, Brazil, Oct. 11, 1921, II, *1210*.

Some of the collections are referred to this species with some doubt. We have included those with large urediniospores having two or three equatorial pores. In the collection on *C. Olfersianus* there are but two pores placed slightly above the equator. We are of the opinion that there are more species of *Puccinia* on *Cyperus* in South America than have yet been recognized. It is necessary, however, to have ample material of both uredinia and telia and many more collections before a satisfactory treatment of them can be made.

5. PUCCINIA CANALICULATA (Schw.) Lagerh. Tromsö Mus. Aarsh **17**: 51. 1894.

Sphaeria canaliculata Schw. Trans. Am. Phil. Soc. II. **4**: 209. 1832.

Dicaeoma canaliculatum Kuntze, Rev. Gen. **3**[3]: 466. 1898.

Cyperus esculentus L. Cochabamba, Bolivia, Feb. 27, 1920, II, III, *339*.

While common in North America and the West Indies, this species has been recorded previously from South America only from British Guiana on *Cyperus* sp.

6. PUCCINIA SUBCORONATA P. Henn. Hedwigia **34**: 94. 1895.

Puccinia antioquiensis Mayor, Mém. Soc. Neuch. Sci. Nat. **5**: 472. 1913.

Cyperus diffusus Vahl. Villa Aspiazu, Sur Yungas, Bolivia, May 31, 1920, II, *693;* Rio de Janeiro, Brazil, Aug. 11, 1921, II, III, *1021;* Taquara, Rio de

Janeiro, Brazil, Aug. 30, 1921, II, III, *1083;* Jacarépaguá, Rio de Janeiro, Brazil, Sept. 4, 1921, II, III, *1089*.

An examination of the type collections of *P. subcoronata* P. Henn. and *P. antioquiensis* Mayor shows that they should be considered synonymous. The differences noted by Mayor do not hold when the ample material in the Holway collections is taken into account. The species is easily distinguished from other rusts on *Cyperus* by the small punctiform sori.

In the original account of *P. subcoronata* the rust is recorded on *Cyperus* sp. The specimen of the type distributed by Ule as no. *1485* Herbarium Brasiliense is labeled on *Cyperus diffusus* Vahl. Besides the type and the above listed collections, this species, always on *Cyperus diffusus*, is known also from British Guiana, Trinidad, and Colombia in South America, and from Costa Rica, Honduras, and Panama in North America.

7. **Puccinia flavo-virens** Jackson & Holway, n. sp.

II. Uredinia hypophyllous, scattered or gregarious on yellowish spots, subcircular or elliptic, large, 0.5–3 mm. across, tardily naked, pulverulent, long covered by the golden yellow epidermis; urediniospores ellipsoid, 16–18 by 24–28 μ; wall colorless or nearly so, thin, 1–1.5 μ, very finely and moderately echinulate, the pores obscure, 2 or 3, equatorial.

III. Telia hypophyllous, blackish brown, scattered or confluent and often covering large areas 1–5 mm. across, often surrounding the old uredinia, long covered by the epidermis; teliospores ellipsoid, clavate, or cylindrical, 12–14 by 32–48 μ, apex obtuse, base rounded or narrowed to the pedicel, scarcely constricted at the septum; wall thin, 1–1.5 μ, light greenish yellow, thickened at apex, 3–6 μ, smooth; pedicel equaling the spore, concolorous.

Cyperus ferax L. C. Rich. Quito, Ecuador, Aug. 17, 1920, II, III, *908* (type).

This species differs from *P. abrepta* Kern which occurs on the same host in Costa Rica in the larger urediniospores with the markings placed farther apart, and in the absence of bullate covering to the pores in the urediniospores. The name selected refers to the olivaceous color of the teliospores when seen under the microscope.

8. **Puccinia obvoluta** Jackson & Holway, n. sp.

II. Uredinia hypophyllous, scattered or gregarious on yellow spots, elliptic, large, 1–2 mm., tardily naked, cinnamon brown, pulverulent, long covered by the overarching epidermis which usually splits at one side; urediniospores globoid or ellipsoid, 22–24 by 26–30 μ; wall light golden brown, 1.5–2 μ in thickness, finely and sparsely echinulate, the pores 2, slightly superequatorial.

III. Telia hypophyllous, usually surrounding the uredinia, scattered or confluent, 0.5–1 mm. across, tardily naked, somewhat pulverulent, blackish brown, long covered by the epidermis; teliospores somewhat irregularly clavate or cylindrical, 12–16 by 42–60 μ, obtuse or acute at apex, narrowed below, scarcely constricted at septum; wall colorless or slightly tinted golden brown, thin, 1 μ or less, rather abruptly thickened at apex, 3–4 μ, smooth; pedicel half the length of the spore or commonly less, reddish brown.

Cyperus ferax L. C. Rich. Rio de Janeiro, Brazil, Dec. 20, 1921, II, III, *1414* (type); Gavea, Rio de Janeiro, Brazil, Jan. 13, 1922, II, *1475*.

This species, while perhaps related to the preceding, differs markedly in the characters of the urediniospores.

9. **Puccinia nociva** Jackson & Holway, n. sp.

II. Uredinia not seen; urediniospores in the telia ellipsoid, 18–20 by 22–26 μ; wall 1.5–2 μ thick, cinnamon brown, finely but distinctly and moderately echinulate, the pores 2, superequatorial.

III. Telia hypophyllous, abundant, scattered or gregarious or confluent in large or small groups, elliptic, 1–1.5 mm. long, somewhat tardily naked, blackish brown, pulverulent, ruptured epidermis conspicuous; teliospores clavate or pyriform, 16–20 by 32–45 μ, apex rounded, obtuse, or occasionally acute, base narrowed to the pedicel, occasionally rounded, slightly constricted at the septum; wall thin, 1.5–2 μ, chestnut brown, smooth, apex greatly thickened, 6–10 μ; pedicel colorless, half the length of spore, usually shorter.

Cyperus Meyerianus Kunth. Sorata, Bolivia, Apr. 11, 1920, II, III, *504*.

This species is distinguished from all others on *Cyperus* which we have examined by the small urediniospores with superequatorial pores.

10. **Uredo nociviola** Jackson & Holway, n. sp.

II. Uredinia hypophyllous, scattered, oblong or linear, 1–3 mm. in length, tardily naked, spore mass cinnamon brown, long covered by the epidermis which usually opens by one longitudinal fissure; urediniospores ellipsoid or oblong, 15–16 by 18–22 μ; wall 1.5–2 μ, cinnamon brown, very finely and closely verrucose, more strongly so in the upper portion; pores two, superequatorial.

Cyperus distans L. f. São Paulo, Brazil, May 24, 1922, *1877* (type).

Cyperus cayennensis (Lam.) Britton. São Caetano, São Paulo, Brazil, Feb. 22, 1922, *1583a*.

No telia or teliospores could be found though the rust is probably a *Puccinia*. It is distinguishable from *P. nociva* by the smaller spores with much less prominent markings. The second specimen listed was segregated from a collection, the bulk of which is determined as *P. Cyperi* Arth.

11. UREDO KYLLINGIAE P. Henn. Hedwigia **35**: 256. 1896.

Kyllinga brevifolia Rottb. Santo Amaro, São Paulo, Brazil, March 16, 1922, *1638*.

Kyllinga pumila Michx. Quito, Ecuador, Sept. 2, 1920, *959*.

Since no telia have been found either in North or South America, it is felt best to list this form by itself. While the urediniospores resemble those of *P. Cyperi* to some extent, the walls are quite constantly practically colorless and they average smaller in size.

12. PUCCINIA SCLERIAE (Paz.) Arth. Mycologia **9**: 75. 1917.

Rostrupia Scleriae Paz. Hedwigia **31**: 96. 1892.

Aecidium passifloricola P. Henn. Hedwigia **43**: 168. 1904.

Dicaeoma Scleriae Arthur, N. Am. Fl. **7**: 349. 1920.

Scleria sylvestris Poepp. & Kunth. Sumaré, Rio de Janeiro, Brazil, Aug. 25, 1921, II, *1071;* Campo Grande, Rio de Janeiro, Brazil, Sept. 19, 1921, II, III, *1129;* Reserva Florestal, Itatiaya, Brazil, May 14, 1922, II, III, *1853;* Taipas, São Paulo, Brazil, June 10, 1922, II, *1952*.

This very characteristic rust is apparently abundant in Brazil, but has not been collected elsewhere on *Scleria* in South America

except on the Island of Trinidad. It is also known from Panama, Cuba, and Porto Rico. In 1918, H. E. Thomas working in Porto Rico conducted cultures which showed that an *Aecidium* on *Passiflora rubra* L. was genetically connected (Phytopathology **8**: 163. 1918). This is considered to be *Aecidium passifloricola*, the type for which was collected in Peru. It should be noted that the rust on *Scleria* has not yet been collected on the west coast of South America. A reexamination of the type of *A. passifloricola* shows, however, no appreciable difference from the aecial material used by Thomas in his cultures. Aecia have been collected on *Passiflora tricuspis* Mast. from Peru; on *P. tuberosa* Jacq. from Trinidad; on *P. rubra* L. from Trinidad, Cuba, Porto Rico, Jamaica; and on *P. biflora* Lam. from Costa Rica.

13. UROMYCES SCLERIAE P. Henn. Hedwigia Beibl. **38**: 67. 1899.

Nigredo Scleriae Arth. Résult. Sci. Congr. Bot. Vienne 344. 1906.

Scleria pratensis Lindl. Reserva Florestal, São Paulo, Brazil, May 14, 1922, II, III, *1849;* Guarujá, São Paulo, Brazil, July 13, 1922, II, III, *2011.*

The type of this species was collected in Southern Brazil by Ule (*2477*). It is also known in South America from Pará at the mouth of the Amazon in Eastern Brazil, Colombia, British Guiana, and Trinidad. In North America it is known only from Porto Rico and Cuba.

14. **Puccinia oblongula** Jackson & Holway, n. sp.

II. Uredinia not seen; urediniospores in the telia broadly ellipsoid, 20–24 by 26–34 μ; wall 1.5–2.5 μ, golden brown, moderately and finely echinulate; pores rather obscure, 2 equatorial.

III. Telia hypophyllous, round or oval, 0.2–0.5 mm. across, tardily naked, chestnut brown, ruptured epidermis conspicuous; teliospores ellipsoid or oblong, 18–24 by 40–70 μ, apex rounded or obtuse, base rounded or narrowed to pedicel, slightly constricted at septum; wall golden or light cinnamon brown, 1–1.5 μ, the apex thickened to 4–7 μ, smooth, germinating at once; pedicel colorless, equaling the spore or shorter.

Rynchospora sp. Quito, Ecuador, Aug. 14, 1920, II, III, *885* (type).

Two other species of *Puccinia* have been described on *Rynchospora*, *P. angustatoides* and *P. rhynchosporicola* Speg. This species differs from both in the character of the teliospores and from the former in the character of the markings and in the position of the pores in the urediniospores.

15. **Uromyces oblectaneus** Jackson & Holway, n. sp.

II. Uredinia amphigenous, chiefly hypophyllous, oval or elliptic, 0.5–1.5 mm. long, early naked, cinnamon brown, ruptured epidermis persistent and conspicuous; urediniospores ellipsoid or obovate, 22–26 by 28–32 μ; wall 2–3 μ in thickness, dark cinnamon brown, sparsely and prominently echinulate; pores 2 or more commonly 3, approximately equatorial.

III. Telia hypophyllous, oval or elliptic, 0.5–2 mm., early naked, blackish brown, ruptured epidermis conspicuous; teliospores irregularly ellipsoid or obovoid, 16–20 by 23–34 μ, base rounded or attenuate, occasionally truncate, apex rounded, obtuse or truncate; wall chestnut brown, 1.5–2 μ in thickness, apex thickened, 4–9 μ, smooth; pedicel equaling the spore, firm, tinted.

Rynchospora exaltata Kunth. Rio de Janeiro, Brazil, Aug. 10, 1921, II, III, *1014;* Sylvestre, Rio de Janeiro, Brazil, Sept. 16, 1921, II, III, *1113* (type); Villa Prudente, São Paulo, Brazil, May 31, 1922, II, III, *1923*.

16. UROMYCES RHYNCOSPORAE Ellis, Jour. Myc. **7**: 274. 1893.

Uromyces rhynchosporicola P. Henn. Hedwigia **35**: 226. 1896.

Nigredo Rynchosporae Arth. Résult. Sci. Congr. Bot. Vienne 344. 1893.

Rynchospora corymbosa (L.) Britton. Ribeirão Pires, São Paulo, Brazil, March 25, 1922, II, *1681;* Guarujá, São Paulo, Brazil, July 13, 1922, II, *2013*.

Rynchospora scaberrima Boeck. Campos do Jordão, São Paulo, Brazil, Apr. 28, 1922, II, *1790*.

The forms with finely verrucose echinulate urediniospores having two equatorial or slightly superequatorial pores are assigned to this species. *Uromyces rhynchosporicola* P. Henn. is included as a synonym, following Sydow who states that it is only

a *Uredo*-form which agrees well with this species. It should be noted, however, that the urediniospores agree also with the correlated *Puccinia angustatoides* R. E. Stone. This species has been reported from South America in the telial stage from Trinidad, on *Rynchospora corymbosa*. All the records of *Uromyces Rhynchosporae* Ellis from South America have consisted of uredinia only. It is therefore entirely possible that part or all of the South American collections may be the uredinia of the *Puccinia*.

SPECIES ON ARACEAE

17. AECIDIUM AROIDEUM Cooke, Grevillea **8**: 71. 1879.

Aecidium Stylochitonis Har. & Pat. Bull. Mus. Hist. Nat. Paris, 201. 1909.

Spathantheum Orbignyanum Schott. Cochabamba, Bolivia, March 10, 1920, *390½*.

Xanthosoma sp. Cochabamba, Bolivia, March 25, 1920, *320*.

The collections listed above are referred to this species with some hesitation. No material has been available for comparison, but since the spore measurements are approximately the same, it has seemed best to assign the collections to this species for the present. The type was collected in Natal, Africa.

SPECIES ON BROMELIACEAE

18. PUCCINIA PITCAIRNIAE Lagerh. Bull. Soc. Myc. Fr. **11**: 214. 1895.

Pitcairnia pungens H.B.K. Quito, Ecuador, Aug. 9, 1920, II, III, *951*.

This collection, made near the type locality, is typical of the species as described by Lagerheim. The urediniospores are large, the walls thick, chestnut brown, sparsely and prominently echinulate and with 2 equatorial pores. Mesospores are abundant, outnumbering the two-celled spores. The only other collection of this species which we have examined was made by Holway at Chapala, Mexico, in 1899 and distributed in Barth. N. Am. Ured. *359* and Fungi Col. *4065*. In this material there are only a very few mesospores and the urediniospores have very thick golden

yellow walls. At first sight the two collections would appear to represent different species. The only other rust on this family from South America is *Uredo Nidularii* P. Henn. which is not related.

SPECIES ON COMMELINACEAE

19. **Phakopsora tecta** Jackson & Holway, nov. nom.

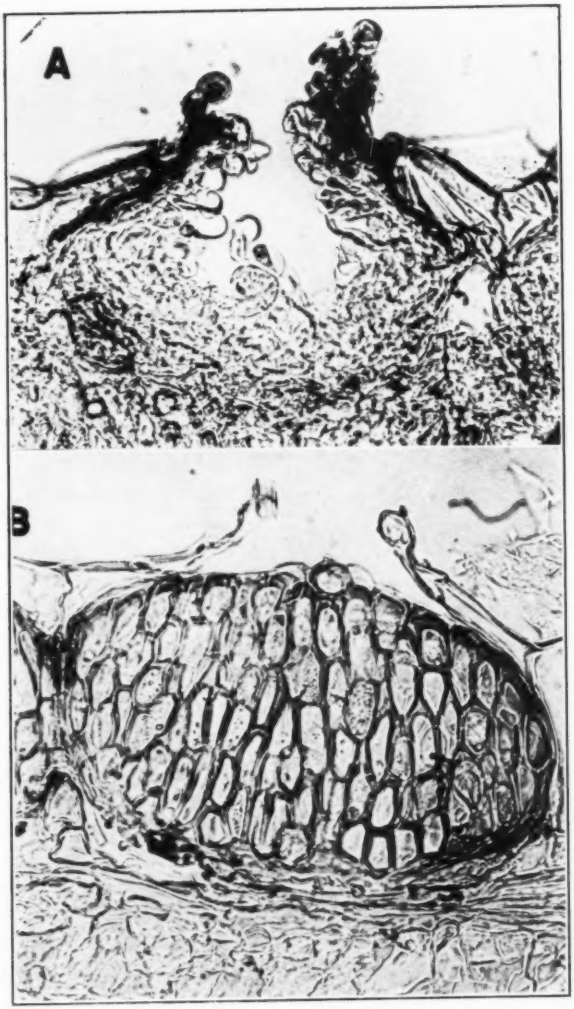
?Uredo Commelyneae Kalchbr. Grevillea **11**: 24. 1882. (Not Speg. 1880.)

II. Uredinia hypophyllous, gregarious in small groups, round or mamillose, 0.1–0.4 mm. across, dark cinnamon brown, long covered by the epidermis, finally opening by a central pore; peridium membranous, apparently formed by the united bases of paraphyses, paraphyses mostly on the inner upper surface of peridium or at the orifice, clavate or capitate, 8–12 μ broad, the wall colorless, or when at the orifice, cinnamon brown, thickened, at apex 5–10 μ; urediniospores somewhat irregularly ellipsoid, 18–22 by 24–32 μ; wall colorless, thin, 1–1.5 μ, closely and finely verrucose or echinulate-verrucose; the pores obscure.

III. Telia hypophyllous, numerous, subepidermal, distinct, closely scattered about the groups of uredinia, occupying large areas of the leaf, circular in outline, small, long covered by the epidermis, compact, punctiform, blackish brown; in section ellipsoid, 190–250 μ broad by 124–160 μ high, arising from the lower part of the mesophyll apparently in the substomatal cavities, without peridium; teliospores 5–6 in series in center of sorus, irregularly ellipsoid or oblong, 13–16 by 24–34 μ; wall thin, 1–1.5 μ, interior spores colorless or slightly tinted and with irregular extension at apex, spores at outer surface of sorus cinnamon brown, and definitely thickened, at apex 6–10 μ.

Commelina quitensis Benth. Sorata, Bolivia, Apr. 16, 1920, II, III, *536* (type).

This species has long been known in America in the uredinial stage on various species of *Commelina*, being referred to *Uredo Commelyneae* Kalchbr. Specimens of this *Uredo* are in the Arthur herbarium from Porto Rico, St. Thomas, Trinidad, and Argentina. The only other collection of telia of which we have any knowledge is one made by G. Mandon at Sorata, Bolivia, date unknown. This specimen came from the herbarium of Dr. G. Lagerheim. It is probable that *Uredo Commelyneae* Kalchbr. which was collected in Natal, South Africa, is synonymous. The



PHAKOPSORA TECTA.
A. SECTION OF UREDINIUM; B. SECTION OF TELIUM.

portion of the type which we have had available for examination, however, is too meager for comparative study of the sori. The spores are apparently like those of the American material. The name *Uredo Commelyneae* (aberrant spelling for *U. Commelinae*) is not, however, a tenable one as Spegazzini used this name in 1880 for the uredinial stage of *Uromyces Commelinae* Cooke.

20. UROMYCES COMMELINAE Cooke, Trans. Roy. Soc. Edin. **31**: 342. 1888.

Uredo Commelinae Speg. Anal. Soc. Ci. Argent. **9**: 172. 1880.

Uredo Spegazzinii De-Toni, in Sacc. Syll. Fung. **7**: 845. 1888.

Uredo ochracea Diet. Hedwigia **36**: 35. 1897.

Uromyces Spegazzinii Arth. Bull. Torrey Club **37**: 573. 1910.

Nigredo Commelinae Arth. N. Am. Fl. **7**: 237. 1912.

Tradescantia elongata Mey. Tremembé, São Paulo, Brazil, Feb. 28, 1922, II, *1604*.

Undetermined *Commelinaceae*. Gavea, Rio de Janeiro, Brazil, Sept. 7, 1921, II, *1092*.

This species is evidently a common one in South America, particularly in southern Brazil and Argentina. It is worthy of note, however, that no telia have ever been found in any of the South American collections. It is entirely possible, therefore, that the assignment of these uredinial collections to the above species may not prove to be correct.

SPECIES ON JUNCACEAE

21. PUCCINIA OBSCURA Schroet. Pass. Nuovo Giorn. Bot. Ital. **9**: 256. 1877.

Dicaeoma obscurum Kuntze, Rev. Gen. **3**^{3}: 469. 1899.

Juncoides excelsum (Buch.) Kuntze. Sorata, Bolivia, Apr. 19, 1920, II, III, *551;* San Felipe, Prov. Sur Yungas, Bolivia, May 19, 1920, II, III, *619;* May 20, 1920, III, *630*.

22. **Uredo macella** Jackson & Holway, n. sp.

II. Uredinia hypophyllous and caulicolous, scattered or gregarious, oval or elliptic, 0.5–1.5 mm., tardily naked, pulverulent, cinnamon or light chestnut brown, ruptured epidermis conspicuous; urediniospores obovate or irregularly ellipsoid, 19–22 by 28–34 μ; wall 1.5–2 μ, cinnamon brown, finely and moderately echinulate, the pores 2, equatorial or slightly subequatorial.

Juncus Dombeyanus Gay. Panamavida, Chile, Dec. 9, 1919, II, *210* (type).

This species is separable from all others on *Juncus* by the large size of the urediniospores. A comparison with the uredinia of *Puccinia juncophila* Cooke & Massee shows that the spores in our material average considerably larger and with thinner walls.

23. UROMYCES JUNCI (Desmaz.) L. Tul. Ann. Sci. Nat. IV. **2**: 146. 1854.

Puccinia Junci Desmaz. Pl. Crypt. *81*. 1825.
Nigredo Junci Arth. N. Am. Fl. **7**: 238. 1912.
Juncus involucratus Steud. Cochabamba, Bolivia, March 1, 1920, II, *355*.

This is a common species in North America and Europe and has been reported a number of times from South America. In North America the aecia are known to occur on Carduaceae including *Ambrosia*, *Arnica*, *Cirsium*, *Helianthus*, etc. No aecia from South America have been assigned to this species, however.

24. UROMYCES SILPHII (Burrill) Arth. Jour. Myc. **13**: 202. 1907.

Aecidium Compositarum Silphii Burrill; De-Toni, in Sacc. Syll. Fung. **7**: 798. 1888.
Uromyces Junci-tenuis Sydow, Monog. Ured. **2**: 289. 1910.
Nigredo Silphii Arth. N. Am. Fl. **7**: 239. 1912.
Juncus cyperoides La Harpe. Puerto Varas, Lago Llanquihue, Chile, Nov. 27, 1919, II, III, *188*.
Juncus imbricatus La Harpe. Panamavida, Chile, Dec. 9, 1919, II, *206*.

The urediniospores show two superequatorial pores and on this account the specimens are assigned as above. While the species has been cultured only to *Silphium* in North America, there is

some field evidence to indicate that other species of Carduaceae are aecial hosts. It should, of course, be recognized that complete knowledge of the life history of the South American forms, together with a careful comparative study of ample material from various localities and on a number of hosts, may result in quite a different assignment of these collections.

An examination of Ule's No. *1254* collected at Tubarão, Sta. Catharina, Brazil, Feb. 1899, on *Juncus dichotomus*, which was recorded by Hennings as *Uromyces Junci* (Hedwigia **35**: 226. 1896), is better referred to the above species as the pores of the urediniospores are superequatorial.

SPECIES ON LILIACEAE

25. **Aecidium Millae** Jackson & Holway, n. sp.

O. Pycnia scattered among the aecia or in a central group, subepidermal, yellowish, globoid or ellipsoid, 80–98 μ in diameter by 96–110 μ high, ostiolar filaments short.

I. Aecia amphigenous, in groups on yellowish spots, 2–8 mm. across; peridium yellowish, firm, margin erose; peridial cells in side view oblong, 19–22 by 26–30 μ, outer wall smooth, 6–8 μ thick, inner wall minutely tuberculate-rugose, 4–5 μ thick, slightly overlapping; aeciospores globoid or ellipsoid, 20–26 by 24–32 μ; wall 1.5–2 μ thick, colorless, closely and strongly verrucose.

Milla Poeppigiana Baker. Termas de Chillan, Chile, Dec. 27, 1919, *249a* (type).

This *Aecidium* was associated with a *Puccinia* on the same host which is referred to *P. Steinmanniae*. The *Aecidium* occurred only on young leaves while the *Puccinia* occurred on mature languishing leaves. We believe that the *Aecidium* is heteroecious and *P. Steinmanniae* is a micro-form.

26. **Puccinia Nothoscordi** Jackson & Holway, n. sp.

I. Aecia few, associated with telia, large, 0.5 mm. across; peridium membranous, erose, yellowish; peridial cells seen only in face view, irregularly polyhedral, 24–26 by 26–32 μ, evidently considerably overlapping, inner wall conspicuously verrucose; aeciospores globoid or broadly ellipsoid; wall thin, colorless, 1–1.5 μ, closely and finely verrucose.

III. Telia amphigenous, gregarious and more or less confluent in groups 5–10 cm. across, tardily naked, pulverulent, blackish,

ruptured epidermis conspicuous; teliospores ellipsoid oblong or pyriform, 18–22 by 34–44 μ, rounded above, rounded or somewhat narrowed below, strongly or not constricted at septum; wall uniformly 1.5–2.5 μ thick, cinnamon or chestnut brown, smooth; pedicel short, colorless.

Nothoscordum sp. Cuzco, Peru, June 29, 1920, I, III, *741* (type).

Only a very few aecial cups were seen associated with the telia. These occurred at the margin, not in the center of the group of sori, and were very old, admitting of only incomplete description.

The teliospores are quite irregular and variable; some rather opaque spores, conspicuously constricted, are present, others are lighter in color and with scarcely any constriction.

This species is either a regular opsis-form or one of those micro-forms which occasionally show the presence of aecia as in *P. Cryptotaeniae* (= *P. microica*).

27. PUCCINIA PASITHEAE Diet. & Neg. Bot. Jahrb. **24**: 156. 1897.

Aecidium Pasitheae Diet. & Neg. Bot. Jahrb. **22**: 356. 1896.

Pasithea coerulea Don. Papudo, Chile, Sept. 17, 1919, II, III, *34;* San José de Maipo, Chile, Oct. 8, 1919, II, III, *93;* Panamavida, Chile, Dec. 17, 1919, III, *243;* Baños de Cauquenes, Rancagua, Chile, Jan. 13, 1920, III, *293*.

While this is evidently a common species in this region, it is otherwise known only from the type collections.

28. PUCCINIA STEINMANNIAE Diet. & Neg. Bot. Jahrb. **24**: 156. 1897.

Milla Poeppigiana Baker. Termas de Chillan, Chile, Dec. 27, 1919, III, *249*.

This collection consisted of aecia and telia. The telia are fully mature on old but not overwintered leaves of the host. The aecia are on young leaves. It is considered probable that the aecia are those of some heteroecious rust and are hence described separately as *Aecidium Millae* n. sp. The telia agree well with the above species and are so assigned. The aspect is that of a micro-form.

29. UROMYCES DUSENII Diet. & Neg. Bot. Jahrb. **27**: 1. 1899.

Gilliesia graminea Lindl. Constitution, Chile, Oct. 19, 1919, I, III, *130*.

Ornithogalum biflorum D. Don, (*Scilla chloroleuca* Kunth). Viña del Mar, Chile, Sept. 5, 1919, *2*.

The only other collection of this species of which we have any record is that of the type made by P. Dusen near Talcomahuida, Chile, on *Gilliesia monophylla* Reiche, which we have not seen. The species is evidently an opsis-form. In our specimen on *Gilliesia* the teliospores are considerably smaller than given in the original description, measuring 18–22 by 26–40 μ. This measurement more nearly corresponds to that given by Sydow as 18–25 by 25–42 μ (Monog. Ured. **1**: 273).

We have included with this species the collection on *Ornithogalum*. The sorus characters correspond and the markings of the teliospore wall are identical in character. The teliospores are, however, somewhat smaller and broader in proportion to the length, often nearly globoid, measuring 20–26 by 24–30 μ.

We have not seen the type of *Uromyces Solariae* Diet. on *Solaria miersioides* but from the description we would suggest the possibility that it is synonymous.

30. UROMYCES TRITELEIAE Diet. & Neg. Bot. Jahrb. **24**: 153. 1897.

Leucocoryne alliacea Lindl. Constitution, Chile, Oct. 18, 1919, I, III, *128*.

A comparison of this collection with the type of *U. Triteleiae* shows substantial agreement and it is so assigned with considerable confidence.

SPECIES ON SMILACACEAE

31. **Sphenospora yurimaguasensis** (P. Henn.) n. comb.

Uredo yurimaguasensis P. Henn. Hedwigia **43**: 164. 1904.

Sphenospora smilacina Sydow, Ann. Myc. **23**: 318. 1925.

Smilax domingensis Willd. Taquara, Rio de Janeiro, Brazil, Aug. 30, 1921, II, *1085*.

Smilax sp. San Francisco, Nictheroy, Rio de Janeiro, Brazil, Sept. 23, 1921, II, *1144;* Cantareira, São Paulo, Brazil, May 30, 1922, II, iii, *1916;* São João, São Paulo, Brazil, July 2, 1922, II, *1988*.

This combination is proposed for the *Sphenospora* which occurs on *Smilax*. This was first recognized by Arthur (Mycologia **10**: 121. 1918, and Am. Jour. Bot. **5**: 434. 1918) from Costa Rica and Guatemala, who assigned it to *Sphenospora pallida* (Wint.) Dietel.

The *Smilax* form is distinct and is now known to occur in Costa Rica, Guatemala, Trinidad, Peru and Brazil. The type of *Uredo yurimaguasensis* P. Henn. has not been seen but the description fits the uredinia of this rust very accurately except that I find only occasional urediniospores with thickened apices.

A full description of this and the preceding species is reserved for another place.

The report of *Puccinia Smilacis* Schw. (Arthur, Bot. Gaz. **73**: 66. 1922) from Trinidad is based on an error in identification. The collection which consists of uredinia only agrees with the species under discussion. It is possible that the other records of *Puccinia Smilacis* Schw. (Pazschke, Hedwigia **31**: 96. 1892, and Sydow, Ann. Myc. **5**: 355. 1907) also belong here as both collections consist of uredinia only. If this is true, then *P. Smilacis* Schw. may not occur in South America.

SPECIES ON AMARYLLIDACEAE

32. AECIDIUM ALSTROEMERIAE Diet. & Neg. Bot. Jahrb. **22**: 355. 1896.

Alstroemeria Pelegrina L. Papudo, Chile, Sept. 19, 1919, *53*.

Alstroemeria sp. San José de Maipo, Chile, Oct. 8, 1919, *95;* Constitution, Chile, Oct. 15, 1919, *117*.

Tecophilaea violaeflora Bert. Olmue, Chile, Sept. 11, 1919, *20;* Papudo, Chile, Sept. 19, 1919, *47*.

Though occurring in the same region with *Puccinia Alstroemeria* Syd. this *Aecidium* is probably heteroecious. The type collection was made on *Alstroemeria Ligtu* L. at Conception, Chile, by F. W. Neger. It is probable that the collection number *1375* of Bertero made at Valparaiso, Chile, on *Alstroemeria* and reported by Montagne (in Gay, Historia de Chile, **8**: 37. 1852) as *Aecidium Allii* belongs here.

33. **Aecidium tenebrosum** Jackson & Holway, n. sp.

O. Pycnia amphigenous, few, scattered or in a small group opposite or among the aecia, flattened globoid, 100–130 μ high by 130–160 μ broad; ostiolar filaments forming a short column.

I. Aecia hypophyllous, occurring singly or in groups of 2–20 on yellowish spots, large, 350–370 μ in diameter; peridium yellowish, firm, overarched, opening irregularly; peridial cells oblong in side view, 12–16 by 24–28 μ, outer wall transversely striate, 3–5 μ in thickness, inner wall 2–3 μ, finely verrucose, abutted or slightly overlapping; aeciospores globoid or ellipsoid, 23–26 by 26–32 μ; wall cinnamon brown, 1.5–2.5 μ thick, finely but prominently verrucose, the pores evident, 8–10, scattered.

Alstroemeria sp. Papudo, Chile, Sept. 18, 1919, *42* (type); Zapallar, Chile, Sept. 22, 1919, *64*.

This species is distinguished from *A. Alstroemeriae* by the larger spores having thick, evidently colored walls, with plainly visible pores.

34. PUCCINIA ALSTROEMERIAE Syd. Monog. Ured. **1**: 603. 1903.

Alstroemeria revoluta R. & P. Termas de Chillan, Chile, Dec. 31, 1919, III, *263*.

Alstroemeria sp. Maipo Valley, Santiago, Chile, Oct. 2, 1919, III, *77;* San José de Maipo, Chile, Oct. 4, 1919, III, *87;* Oct. 6, 1919, *90;* Oct. 8, 1919, III, *94*.

A very distinct species otherwise known only from the type collection made on *A. revoluta* at Cordillera de St. Fernando, Chile. Collection No. *94* bears some *Aecidium Alstroemeriae* Diet. & Neg. on the same leaves. Field observations made by Prof. Holway, however, indicate that there is no genetic connection. *P. Alstroemeriae* is apparently a micro-form while *Aecidium Alstroemeriae* is presumably heteroecious.

35. PUCCINIA BOMAREAE P. Henn. Hedwigia **35**: 242. 1896.

Uredo Bomareae Lagerh. in Pat. & Lagerh. Bull. Soc. Myc. France **11**: 215. 1895.

Bomarea Caldasiana (H.B.K.) Herb. Quito, Ecuador, Aug. 14, 1920, II, *887*.

Bomarea ovata (Cav.) Mirb. São João, São Paulo, Brazil, March 19, 1922, III, *1654*.

Bomarea sp. Sorata, Bolivia, Apr. 26, 1920, II, III, *574*.

36. PUCCINIA HABRANTHI Diet. & Neg. Bot. Jahrb. **24**: 157. 1897.

Hippeastrum pratense (Poepp.) Baker. Papudo, Chile, Sept. 17, 1919, I, III, *35;* Temuco, Chile, Nov. 3, 1919, III, *163.*

Hippeastrum bicolor (R. & P.) Baker. Constitution, Chile, Oct. 15, 1919, III, *115.*

Uredinia were not seen but mammoth urediniospores, 32–38 by 48–56 μ, with colorless walls were noticed in one collection. In this species the wall of the teliospore is finely and closely verrucose, making it easy to distinguish this from *P. Reichei* on which the markings are coarsely tuberculate. The type collection was made on *Habranthus andicola* Herb. and in the portion we have examined the markings of the teliospores are very fine and inconspicuous, while on *Hippeastrum pratense* the markings are somewhat more prominent and even more so on *Hippeastrum bicolor.*

37. PUCCINIA PALLOR Arth. & Holw. Mycologia **10**: 129. 1918.

Eriosporangium Pallor Sydow, Ann. Myc. **20**: 122. 1922.
Dicaeoma Pallor Arth. N. Am. Fl. **7**: 379. 1920.

Bomarea sp. San Felipe, Sur Yungas, Bolivia, May 20, 1920, II, III, *629.*

This species has waxy telia with colorless spores which germinate at once, and has been reported previously only from Guatemala and Costa Rica.

38. PUCCINIA REICHEI Diet. & Neg. Bot. Jahrb. **24**: 157. 1897.

Hippeastrum chilense (R. & P.) Baker. Termas de Chillan, Chile, Dec. 3, 1919, I, III, *265.*

Hippeastrum pratense (Poepp.) Baker. Papudo, Chile, Sept. 18, 1919, I, III, *37.*

No authentic collection of this species has been available but the specimens fit the description admirably and there can be little doubt that they are correctly assigned. The first collection listed is on the type host (as *Habranthus chilensis* Herb.) and from the same general region. The species is evidently an opsisform, aecia and telia being abundant in both collections.

39. UREDO HYPOXIDIS (Bres.) P. Henn. Hedwigia Beibl. **40**: 173. 1901.

Doassansia Hypoxidis Bres. in Rab.-Paz. Fungi Eur. *4201.* 1901.

Uredo globulosa Arth. Mycologia **8**: 22. 1916.

Hypoxis decumbens L. Sumaré, Rio de Janeiro, Brazil, Aug. 25, 1921, *1070.*

Hypoxis sp. Taipas, São Paulo, Brazil, June 10, 1922, *1951.*

There seems to be no sufficient reason for considering this *Uredo* a synonym of *Uromyces affinis* Wint. While Sydow (Monog. Ured. **4**: 515. 1924) gives the pores as 6–8 scattered, we could not make them out with certainty. The species is abundant in South America, Central America and the West Indies.

40. UROMYCES ALSTROEMERIAE (Diet.) P. Henn. Hedwigia Beibl. **38**: 67. 1899.

Uredo Alstroemeriae Diet. Hedwigia **36**: 35. 1897.

Alstroemeria inodora Herb. Reserva Florestal, São Paulo, Brazil, May 11, 1922, II, III, *1843.*

Alstroemeria Isabellana Herb. Itatiaya, São Paulo, Brazil, May 18, 1922, II, III, *1862.*

SPECIES ON DIOSCOREACEAE

41. SPHENOSPORA PALLIDA (Wint.) Dietel, E. & P. Nat. Pfl. 1^{1**}: 70. 1897.

Diorchidium pallidum Wint. Grevillea **15**: 86. 1887.

Uredo Dioscoreae P. Henn. Hedwigia **35**: 255. 1896.

Puccinia Sphenospora Sydow, Monog. Ured. **1**: 838. 1904.

Dioscorea grandiflora Mart. Paineiras, Rio de Janeiro, Brazil, Aug. 14, 1921, II, iii, *1037;* Gavea, Rio de Janeiro, Brazil, Sept. 8, 1921, II, iii, *1096.*

Dioscorea sp. Nictheroy, Rio de Janeiro, Brazil, Aug. 18, 1921, II, iii, *1053.*

The genus *Sphenospora* was founded by Dietel on a collection made by E. Ule near San Francisco, Brazil (No. *143*). The rust was first described by G. Winter (Grevillea **15**: 86. 1887, and

Hedwigia **26**: 117. 1887) as *Diorchidium pallidum*. It was recorded as occurring on the leaves of some sort of climbing plant. Dietel in his first discussion of the rust (Ber. Deutsch. Bot. Ges. **10**: 62. 1892) records the host as *Dioscorea*. Later in connection with the establishment of the genus *Sphenospora* he does not mention *Dioscorea*. The Sydows (Monog. Ured. **1**: 838. 1904) in connection with their redescription of the rust under the name *Puccinia sphenospora* nov. nom., based on the original collection, repeat Winter's original statement with reference to host. Later they record (Ann. Myc. **14**: 67. 1916) *Sphenospora pallida* (Wint.) Diet. from the same general region on *Dioscorea trifida* L. (E. Ule *3510*), but express doubt that the original collection on which the name was based is on *Dioscorea* and note certain differences in the size of the teliospores in the two collections.

In addition to the collections listed above, the writer has recently received for study three other collections of *Sphenospora* on *Dioscorea* from Costa Rica and Panama.

In 1918, Arthur recorded (Mycologia **10**: 121. 1918) *Sphenospora pallida* on *Smilax* from Costa Rica and Guatemala. I have specimens also from Trinidad and Brazil.

The forms on *Dioscorea* and *Smilax* represent distinct species and the question arises as to the proper assignment of the original name. At the present writing this cannot be done with absolute certainty but the small size and globoid character of the urediniospores as described by Dietel and Sydow, together with the character of the telia and teliospores as described by Winter, Dietel and Sydow, indicates that the form on *Dioscorea* was the one first described.

The main point of difference in the two forms which I have noted is in the pores of the urediniospores. In the form on *Dioscorea* there are four or more irregularly equatorial pores, while in the form on *Smilax* there are two equatorial pores. There are important differences also in the teliospores.

There can be little doubt that *Uredo Dioscoreae* P. Henn. is the same. The type locality is in the same general region as that in which the above collections were made and the urediniospores agree in shape, size and pore characters. The host is the same. Our material consists primarily of uredinia but there are a few telia or teliospores in the uredinia, in all three collections.

Whether all the collections which have been referred to *Uredo Dioscoreae*, especially those of the West Indies, belong here is an open question.

SPECIES ON IRIDACEAE

42. PUCCINIA ANGULATA Diet. & Neg. Bot. Jahrb. **24**: 156. 1897.

Sisyrinchium junciforme Poepp. Papudo, Chile, Sept. 18, 1919, II, III, *46*.

Sisyrinchium pedunculatum Hook. Zapallar, Chile, Sept. 22, 1919, II, III, *60;* Zapallar, Chile, Jan. 31, 1920, II, III, *304*.

Sisyrinchium sp. San José de Maipo, Chile, Oct. 6, 1919, II, III, *89;* Panamavida, Chile, Dec. 15, 1919, II, III, *233;* Pichilemu, Chile, Oct. 12, 1919, II, III, *110*.

This is a very distinct species in which the telia are long covered by the epidermis and is not to be confused with *P. straminea* in which the telia are open. This species is also known from Mexico.

43. **Puccinia Cypellae** Jackson & Holway, n. sp.

III. Telia amphigenous, scattered singly or in groups 1–2 mm. in length on yellowish spots, oval, 0.5–2 mm. long, tardily naked, somewhat pulverulent, blackish brown, ruptured epidermis conspicuous; teliospores ellipsoid or oblong, often irregular, 18–22 by 30–38 μ, rounded above, rounded or truncate below, slightly constricted at the septum; wall uniformly 1.5–2 μ thick or occasionally slightly thickened to 3 μ over apical pore, finely and faintly verrucose; pedicel colorless or slightly tinted, firm, short, broad at point of attachment to 10 μ.

Cypella sp. La Paz, Bolivia, March 27, 1920, III, *472* (type).

A very distinct species, differing from any others on Iridaceae in the roughened spores.

44. PUCCINIA STRAMINEA Diet. Hedwigia **38**: 249. 1899.

Sisyrinchium sp. Therezopolis, Rio de Janeiro, Brazil, Oct. 6, 1921, II, III, *1193*.

This collection agrees well with the type. We find in the type and in our own collection spores with apices thickened to 10 μ.

It seems entirely possible that this species is not different from *P. Sisyrinchii* Mont.

45. **Uredo tenebrosa** Jackson & Holway, n. sp.

II. Uredinia amphigenous, scattered or occasionally confluent lengthwise, intercostal, on purplish spots, elliptic or linear, 0.5–1.5 mm. long, tardily naked, chestnut brown, pulverulent, long covered by the epidermis which ruptures along one side; urediniospores obovoid, 20–24 by 24–30 μ; wall cinnamon to chestnut brown, thick, 2.5–3.5 μ, finely and rather sparsely echinulate; pores 3 or 4, equatorial.

Undetermined *Iridaceae*, Curityba, Paraná, Brazil, June 20, 1922, II, *1976*.

46. **Uromyces Bunsteri** (Neger) n. comb.

Aecidium Bunsteri Neger, Anal. Univ. Chile **93**: 778. 1896.

Uromyces Sisyrinchii Mont. in Diet. & Neg. Bot. Jahrb. **22**: 349. 1896. (Description only.)

Uromyces probus Arth. Bull. Torrey Club **38**: 376. 1911.

Uromyces sisyrinchiicola Speg. Bol. Acad. Nat. Cienc. Cordoba **27**: 352. 1924.

Nigredo proba Arth. N. Am. Fl. **7**: 243. 1912.

Sisyrinchium cuspidatum Poepp. Panamavida, Chile, Dec. 15, 1919, II, III, *236;* Termas de Chillan, Chile, Jan. 4, 1920, I, III, *272*.

Sisyrinchium graminifolium Lindl. Papudo, Chile, Sept. 18, 1919, II, III, *44;* Constitution, Chile, Oct. 15, 1919, II, III, *113*.

Sisyrinchium sp. Panamavida, Chile, Dec. 17, 1919, II, III, *242*.

It is quite evident that this *Uromyces* is common in Chile. The telial stage was first described by Dietel and Neger on *S. graminifolium*, who, however, used the old name *Uromyces Sisyrinchii* Mont. They found on their specimens both a *Uromyces* and the uredo and telia of *Puccinia Sisyrinchii* Mont. and interpret Montagne's description of *Uromyces Sisyrinchii* to have been based on a similar mixture and that Montagne described the uredinia of the *Uromyces* as *Uromyces Sisyrinchii* and

not the uredinia of the *Puccinia*. It does not appear from their account that they examined the type material. Hariot (Bull. Soc. Myc. Fr. **7**: 198, 199. 1891) and Sydow (Monog. Ured. **2**: 601. 1903), however, having examined the original collections involved, agree that *Uromyces Sisyrinchii* Mont. is based on the uredinia of the *Puccinia*. In any case it seems best to accept the decision of Hariot and Sydow.

The species was next described by Arthur as *Uromyces probus* from material collected in the state of Washington. This is now known also from Utah.

Spegazzini has recently described what appears to be the same species from southern Patagonia on *S. iridifolia*. A collection made by Dr. R. Thaxter at Punta Arenas, Magellan Straits, near where Spegazzini's collection was obtained is in the Arthur Herbarium and agrees with the Holway material.

Aecidium Bunsteri Neg. was described on *S. andinum* Phil. from Chile. Neger writes (translating freely): ". . . in *Aecidium Bunsteri* many peridia are united into an extended series. This arrangement is very noticeable as the aecia begin to appear. The leaves are traversed by parallel, fairly evident veins. In these veins of the leaves the aecia are formed." While we have not seen the type, this arrangement, as well as the microscopic characters so far as described, fits our material so admirably that we venture to make the above combination. This arrangement of the aecia is also noticeable in *Uromyces probus* and is mentioned by Spegazzini in his description of *U. sisyrinchiicola*.

SPECIES ON CANNACEAE

47. PUCCINIA CANNAE (Wint.) P. Henn. Hedwigia **41**: 105. 1902.

Uredo Cannae Wint. Hedwigia **23**: 172. 1884.

Puccinia Thaliae Diet. Hedwigia **38**: 250. 1899.

Dicaeoma (?) *Cannae* Arth. N. Am. Fl. **7**: 380. 1920.

Canna sp. Nictheroy, Rio de Janeiro, Brazil, Dec. 27, 1921, II, *1427*.

Apparently a very common species in Brazil, having been reported a number of times on various species of *Canna*. It is also known in South America from British Guiana, Trinidad, and Colombia, and is common in the West Indies.

Puccinia Thaliae Diet. on *Thalia dealbata* Fraser in the Marantaceae, the type of which was collected at Rio de Janeiro, is included on the authority of Arthur (N. Am. Fl. **7**: 380. 1920) who also reports it on *Maranta arundinacea* L. from Trinidad.

SPECIES ON ORCHIDACEAE

48. UREDO LYNCHII Plowr. Monog. Br. Ured. Ust. 259. 1889.

Trichobasis Lynchii Berk. Gard. Chr. II. **8**: 242. 1877.

Spiranthes nitida Cogn. Therezopolis, Rio de Janeiro, Brazil, Oct. 11, 1921, II, *1214*.

This collection is referred to this species with some doubt. The spores measure 18–22 by 26–28 μ, the wall is 2.5–3.5 μ thick, rather sparsely but very prominently echinulate. The orchid rusts are difficult to identify with any certainty. There are probably many more names than species.

49. UREDO sp.

On terrestrial orchid, Nictheroy, Rio de Janeiro, Brazil, Sept. 23, 1921, *1150*.

The sori are minute, in groups, usually several around a large central sorus, on discolored spots 1–3 mm. across; spores 18–22 by 22–28 μ, the wall golden brown, 2.5–3 μ thick, sparsely and finely echinulate verrucose, pores evident, 3, equatorial.

The host has thin, elliptic leaves 5–6 inches in length and half as broad.

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NEW SPECIES OF FUNGI FROM MISSISSIPPI

L. E. Miles

Mississippi is practically untouched territory as far as the mycologist is concerned. It is true that two of the industrious older workers in this field, S. M. Tracy and F. S. Earle, did considerable collecting and described a number of new species from this state some years ago, but when the extent and varied nature of the vegetation is considered, it must be realized that the surface has scarcely been touched.

The thirteen new species here described represent specimens picked up at random in the course of casual collections made at intervals, as other duties would permit, during a two-year stay in the state. Very few of the more desirable collecting grounds were even touched, but enough was seen to lead one to believe that an abundant harvest would be reaped by one to whom the opportunity should be presented to spend some time in their reaches.

1. **Asterella Myricae** sp. nov.

Spots none; mycelium very scant or obsolete, when present black brown, delicate; perithecia hypophyllous, gregarious, suborbicular to elliptical, depressed hemispherical, astomous, black, fibrillose at the edges, 300–400 μ in diameter, aparaphysate; asci numerous, broadly ovate to elliptical, sessile, 28–30 $\times$ 15–18 μ; spores inordinate to subtristichous, ovate-oblong, 1-septate in the middle, slightly constricted, lower cell slightly heavier, obtuse at each end, hyaline, 12–15 $\times$ 4.5 μ.

On living leaves of *Myrica carolinensis*, Vancleave, Mississippi, *501* (type).

This species occurs on the lower sides of the leaf exclusively and superficially has the appearance of a *Leptothyrium* or fly-speck fungus. The mycelium may be entirely absent, and when present is so scant as to be invisible to the unaided eye. The perithecia are usually rather remotely grouped but sometimes occur singly. The fungus was found on the same leaves with *Mycosphaerella Myricae* described below.

2. **Dimerium nigrosporum** sp. nov.

Epiphyllous; mycelium light fuscous, parasitizing that of some sterile *Meliola* colony, branching but little, somewhat flexuous, septate, 3–5 μ in diameter; perithecia numerous, superficial, sphaeroid, delicately membranous, black, parenchymatic, astomous, but tearing open in a stellate manner at the top with the lobes folding back, 180–200 μ in diameter; asci 3–5 in a perithecium, globose, heavily tunicated, strongly thickened at the apex, briefly subpedicellate at the base, 8-spored, 60–65 μ in diameter, paraphysate; paraphyses numerous, flexuous, hyaline; spores conglobate, oblong or oblong-ellipsoid, rounded at each end, in the middle 1-septate, strongly constricted, in the beginning dilute olivaceous, at length very dark fuscous to black, 40–45 $\times$ 18–20 μ.

On the sterile mycelium of some species of *Meliola* on leaves of *Ilex coriacea*, Poplarville, Mississippi, *512* (type).

The colonies of *Meliola* vary considerably in size, being from two millimeters in diameter to indefinite patches which cover practically the entire upper surface of the leaf. They are black and crustose with indefinite fibrillose edges. The perithecia of the *Dimerium* are scattered thickly over the entire surface of the older ones. All stages of spore maturity as indicated by colors varying from almost hyaline to an intense black are sometimes found in a single perithecium, and occasionally even in the same ascus. In no case was the *Meliola* observed to be fruiting.

3. **Mycosphaerella Leucothoës** sp. nov.

Spots amphigenous, circular, definite, fuscous to gray in color, girded by a narrow, raised, dark brown line, 2–8 mm. in diameter, often three or more confluent when the raised border disappears within the large, rather irregular spot produced, but remains about it. Perithecia immersed, erumpent, epiphyllous, black, globose, 125–140 μ in diameter, concentrically arranged about a small, sterile, darker colored, circular area in the center of the spot, aparaphysate, with a small ostiole; asci clavate, sessile, usually curved, thin-walled, not thickened at the apex, 67–75 $\times$ 15 μ; spores monostichous, obliquely arranged, oblong to oblong-ovate, hyaline, very unequally septate, 15–17 $\times$ 5–6 μ, lower cell 3.5 $\times$ 4 μ.

On persistent but still living leaves of *Leucothoë axillaris*, Poplarville, Mississippi, *447* (type).

Differs from *Sphaerella Andromedae* Tracy & Earle in all particulars.

4. **Mycosphaerella Myricae** sp. nov.

Spots amphigenous, various in size and shape, occurring most frequently at the edge of the leaf, 5 mm. to 2 or more centimeters in diameter, brown to red brown in color, bordered by a very narrow purplish brown line, with quite frequently a narrow cinereous band inside; perithecia epiphyllous, minute, numerous, immersed, erumpent, black, 75 μ in diameter, aparaphysate, globose; asci clavate to ovate lanceolate, sessile, 48–58 $\times$ 10–12 μ; spores subdistichous, cylindrical, septate in the middle, not constricted, obtuse at each end, upper locule slightly heavier, 16–20 $\times$ 3–3.5 μ, hyaline.

On leaves of *Myrica carolinensis*, Vancleave, Mississippi, *499* (type), *502*.

Differs from *Mycosphaerella pardolata* Cooke & Ellis in the much larger spores.

5. **Phyllachora scleriicola** sp. nov.

Spots none, but the occupied portions of the leaf becoming paler; stromata usually epiphyllous, innate, very numerous, oblong or elliptical, 0.5–1 mm. long, 0.2–0.5 mm. wide, encrusted, jet black, somewhat seriately disposed; locules numerous, subglobose or angulate from mutual crowding; asci cylindric to cylindric-clavate, briefly and usually obliquely pedicillate, 100–110 $\times$ 14–17 μ, 8-spored; paraphyses numerous, filiform; spores ellipsoid, usually transversely or obliquely monostichous, continuous, hyaline, obscurely 1-guttulate, contents granular, 12–14 $\times$ 6–7 μ.

On living leaves of *Scleria triglomerata*, Lucedale, Mississippi, *457* (type).

Differs from *Phyllachora Scleriae* Rehm in its larger asci, the shape of the spores, and the fact that the locules are never solitary in the stroma; from *Phyllachora graminis* (Pers.) Fuckel in its larger asci and spores.

6. **Scolecodothis pinicola** sp. nov.

Stromata on both sides of the needles, not in spots, but irregularly scattered, black, glistening, elliptical, convex, 0.7–1 mm. long, 0.3–0.5 mm. wide, between the epidermis and palisade tissue; clypeate crust black, inclosing the epidermal cells, 15–18 μ thick, with a thin streak or split extending throughout its length, through which dehiscence occurs; locule single, large, occupying the entire inner space, 280–300 μ wide, 130 μ high, sitting on a

thin, hyaline hypothecium; asci cylindrical, straight, sessile, abruptly acute at the apex, 80–95 × 12–14 μ, eight-spored, paraphysate; paraphyses numerous, filiform, briefly arched at the tips, 100–125 μ long; spores filiform, parallel, straight or slightly bent at the apex, undivided, 75–85 × 2 μ, hyaline.

On fallen needles of *Pinus taeda*, Starkville, Mississippi, *530* (type).

The stroma of this fungus is *Phyllachora*-like in appearance. The position between the palisade tissue and the epidermis, the filiform spores and presence of paraphyses place it in the genus *Scolecodothis*, established by Thiessen and Sydow in 1915. The species is locally abundant in the region where it was collected.

7. **Phyllosticta Ceanothi** sp. nov.

Spots amphigenous, suborbicular, definite, small, 1–2 mm. in diameter, red brown, limited by a narrow, dark purple-brown line, rarely confluent; pycnidia epiphyllous, scattered, globose, semi-immersed, black, 90–100 μ in diameter, with a small ostiole; spores globose to broadly elliptical or occasionally subpyriform, 6–8 μ wide, granulose, hyaline.

On living leaves of *Ceanothus americana*, Columbia, Mississippi, *458* (type).

The small dark red-brown spots produced by this fungus often occupy a considerable portion of the leaf surface, yet they rarely become confluent. They are invariably paler, though quite distinct on the lower side of the leaf. In the locality where collected the spot was very abundant.

8. **Phyllosticta Rhynchosiae** sp. nov.

Spots amphigenous, small, suborbicular or angulose, 1–2 mm. in diameter, rarely confluent, fuscous brown when young, becoming darker with age, and the center becoming cinereous, bordered by a narrow purple brown line; pycnidia epiphyllous, fuscous brown, globose, delicate in texture, barely perforating the epidermis with a small ostiole, 85–95 μ in diameter; spores globose to broadly ovate, 7–8 μ in width, hyaline.

On living leaves of *Rhynchosia erecta*, Columbia, Mississippi, *459* (type).

9. **Septoria Bumeliae** sp. nov.

Spots amphigenous, subcircular, 2–5 mm. in diameter, at first roseate in color, later becoming grayish white, often confluent,

when they become irregular and angulose in outline, bounded by a very narrow, slightly raised, purple to black line, the thin translucent portions within which have a tendency to fall out in the old spots, giving a shot-hole effect; pycnidia epiphyllous, numerous, black, distinct against the white background, 80–100 μ in diameter, globose, rather broadly ostiolate; spores slender, curved or flexuous, pluriguttulate, in maturity becoming 4–6-septate, 50–70 $\times$ 2–2.5 μ, hyaline.

On living leaves of *Bumelia lycioides*, Lucedale, Mississippi, *483* (type), Ocean Springs, *722*, Biloxi, *763*.

The spots resemble very much those of *Phyllosticta Bumeliae* Underw. & Earle on the same host, but differ in their smaller size, the roseate color of the young spots, and the smaller number of pycnidia. The thin, translucent, rosy to white spots are usually quite numerous on the infected trees. The narrow, dark purple to black border is very distinct and beyond it there is often a rather broad halo which shades off into the normal leaf tissue. The black pycnidia which stand out so sharply against the thin white background are quite visible on the under side of the leaf, though they occur on the upper side only.

10. **Septoria Valerianellae** sp. nov.

Spots amphigenous, small, circular to elliptical, 1–3 mm. in diameter, light fuscous, becoming pale and dried out, surrounded by a narrow, indefinite, slightly darker line; pycnidia amphigenous, usually epiphyllous, immersed or erumpent, with a minute ostiole, black, globose, 70–80 μ in diameter; spores filiform-bacillar, straight or somewhat flexuous, continuous or obscurely 1–2-septate, 28–33 μ in length, hyaline.

On living leaves of *Valerianella radiata*, A. & M. College, Mississippi, *509* (type), *559*.

This fungus causes the affected plants to become paler in color due to a yellowing of the affected leaves beyond the spots, and is, therefore, readily observed in the field. Our species differs from *Septoria Valerianae* Sacc. & Fautr. described on *Valeriana dioica* in France, in its much longer and differently shaped spores.

11. **Monochaetia Camelliae** sp. nov.

Acervuli punctiform, gregarious, smoky black, subcutaneous, 300–400 μ in diameter, rupturing the cutin irregularly; conidia 4-septate, fusoid, pointed at each end, not constricted, 18–20

× 4–4.5 μ, interior loculi fuscous olivaceous, basal locule usually dilutely colored, apical locule hyaline and terminated by a single, stipitate, filiform hyaline seta, straight or bent at a right angle near its point of union with the spore, 12–14 μ long.

On leaves of *Camellia japonica*, Columbus, Mississippi, *460* (type).

12. **Cercospora Xyridis** sp. nov.

Spots amphigenous, oval, 2–4 mm. long, brown, margin purple brown; hyphae amphigenous, mostly hypophyllous, fasciculate, 2–6 in each group, erect rigid, nodulose toward the apex, pruinose in color, more dilute toward the top, 1–3-septate, 100–130 μ long; conidia hyaline, 4–5-septate, subcylindraceous or gradually attenuate to the apex, 50–60 × 3 μ.

On living leaves of *Xyris elata*, Wiggins, Mississippi, *455* (type).

The leaves of plants affected by this fungus often become browned throughout the occupied area, in which case the outline of the spots becomes indistinct.

13. **Volutella caricicola** sp. nov.

Sporodochia numerous, amphigenous, sessile, applanate, at first cinereous, becoming dark olivaceous to almost black, 75–100 μ in diameter, occupying the entire areas of dead leaves; setae numerous, erect, rigid, gradually tapering from the base, arranged to form a complete border about the sporodochium, dark pruinose-violaceous, scarcely septate, becoming lighter in color toward the apex, 50–100 μ long; conidiophores simple, cylindrical, continuous; conidia falcate to fusiform, curved at apex, acute at each end, 20–28 × 5–5.5 μ, hyaline.

On dead portions of leaves of *Carex cherokeensis*, A. & M. College, Mississippi, *463* (type).

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NOTES ON TESTICULARIA CYPERI

C. W. Edgerton and E. C. Tims

(With Plate 20 and 1 Text Figure)

According to the published literature, the smut, *Testicularia Cyperi* Klotzsch, is of rather rare occurrence. Clinton[1] lists but a single collection in North America, this having been made at Wading River, New York. It is doubtful if many more collections have found their way into herbaria.

In southern Louisiana this smut is not uncommon. During the past few years it has been collected a number of times at Baton Rouge and sometimes has been seen in considerable abundance. Probably if a systematic search were made it would be found to be quite common. Specimens from Louisiana were first determined by H. S. Jackson of Purdue University, the material being sent to him at his request. He stated also that he had seen specimens from Texas.

The sori of *Testicularia Cyperi* take the place of the developing ovules of the sedge, *Rynchospora corniculata* (Plate 20, Fig. 1). They are usually rather scattering, ordinarily about one to three and rarely more than four or five on a single plant. As all the other seed on the plant develop normally, it is evident that each sorus or each group of sori develops from a separate infection. It would appear as if the infection takes place about the time the plants are in flower.

The sori vary in size from that of a small pea up to 26–30 mm. in length by 15 mm. in width. They are usually ovoid or cone shaped, being widest near the base and gradually tapering to the tip. They are whitish or slightly grey in color. A sorus (Plate 20, Fig. 2) consists of a hard false membrane enclosing a mass of spore balls which are separated from each other by a network of mycelial threads. The false membrane is about a half millimeter or more in thickness and is somewhat leathery in texture. The spore balls vary somewhat in size up to a diameter of slightly

[1] Clinton, G. P. Ustilaginales. N. Am. Fl. 7: 45. 1906.

more than 300 μ. Each spore ball (PLATE 20, FIG. 3) consists of a single layer of spores surrounding a large central portion made up entirely of sterile pseudoparenchymatous cells. The spores are nearly spherical in shape and about 11–13 μ in diameter. These measurements are slightly less than those given by Clinton (13–16 μ). The heavy brown wall of the spore is slightly granular or reticulate.

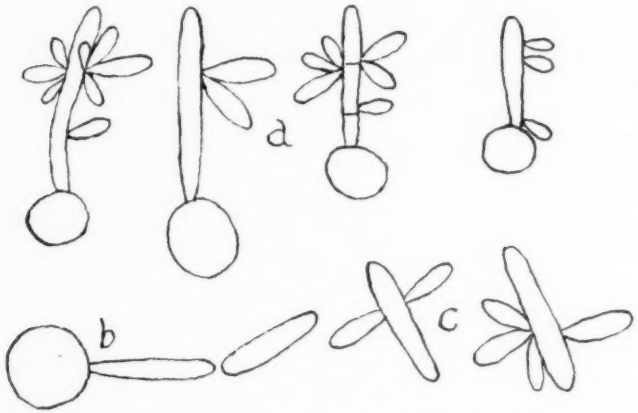
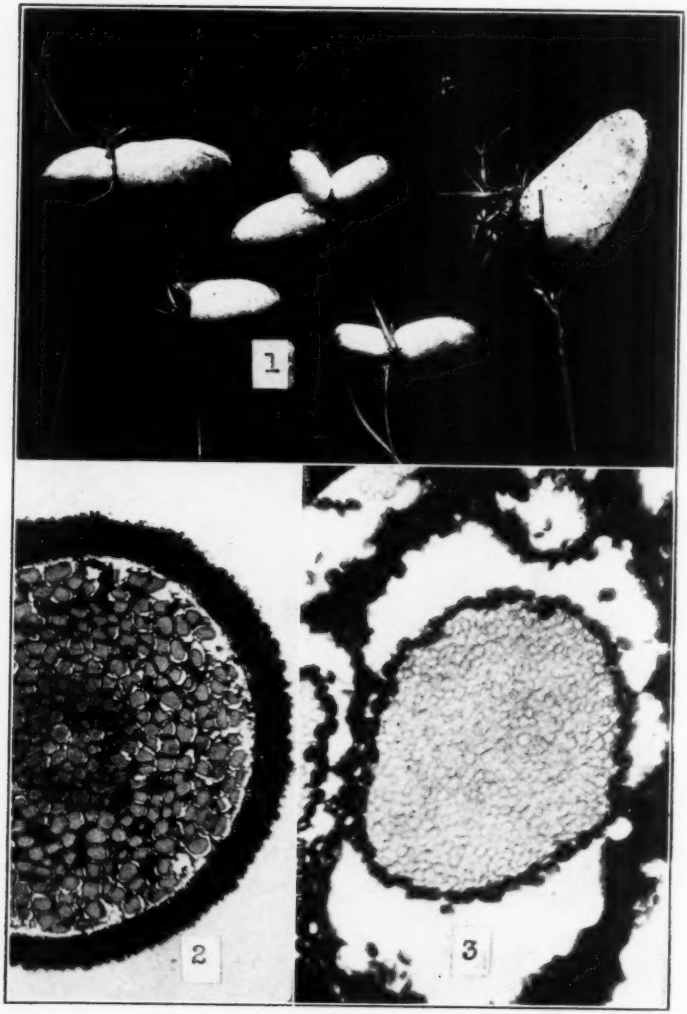


FIG. 1. Outline drawings of spore germination of *Testicularia Cyperi:* (a) formation of sporidia on promycelium; (b) breaking apart of the promycelium; (c) sporidia formation of segments of the promycelium.

As Clinton states that the germination of the spores of *Testicularia Cyperi* is unknown, some tests were made. The spores germinate very readily at maturity if placed in water or a weak sugar solution. A promycelium is produced which later becomes more or less septate though the septa are not always clear. As is characteristic of the family Ustilaginaceae, the sporidia develop on the side of the promycelium (TEXT FIG. 1*a*). A large number of sporidia may be produced by a single one. In drop cultures, the promycelium, or a portion of it, detaches itself from the empty spore at the least jar and continues to develop the small elongated sporidia for some time (TEXT FIG. 1*b*, *c*).

An attempt to germinate spores which had been kept in the laboratory in a dry condition from August until February was



TESTICULARIA CYPERI

not successful. Not a spore that had been dry that length of time would germinate.

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EXPLANATION OF PLATE 20

Fig. 1. Sori of *Testicularia Cyperi*. Natural size.
Fig. 2. Cross section of sorus. Magnification 15 ×.
Fig. 3. Cross section of spore ball. Magnification 245 ×.

A NEW SPECIES OF ARAIOSPORA FROM BRITISH GUIANA [1]

DAVID H. LINDER

(WITH PLATE 21)

Heretofore, *Araiospora*, one of the less well known members of the Leptomitaceae, has been found only in temperate countries, and there but rarely. The previous records of the occurrence of this genus, while few in number, might perhaps be regarded as indicating its restriction to temperate conditions. For example, Thaxter (**2**) has described *Araiospora pulchra* Thaxter, from Maine and Massachusetts, and Cornu (**1**) and von Minden (**3**) have recorded *Araiospora spinosa* (Cornu) Thaxter, from France and Germany respectively. While collecting in British Guiana as a Sheldon Travelling Fellow from Harvard, however, the writer discovered another species there under really tropical conditions, only seven degrees north of the Equator. It was first found rather commonly in the flat clayey coastal region around Georgetown growing on submerged or partly submerged fruit of *Spondias lutea* Linn. (hog plum), on the more or less soft inner surface of green cocoanut husks, and also on recently fallen and submerged twigs. Later it was collected among the sandhills in the vicinity of Bartica, on the Essequibo River system, growing on the submerged fruit of a member of the Bignoniaceae. From its occurrence on several substrata, in Georgetown and in Bartica, it would appear to be widespread, but it should be noted that when thus found the fungus was always in its zoösporangial or non-sexual stage.

The oögonial or sexual stage was sought for at different seasons of the year—before, in the middle, and at the end of the rainy season—but with no success. Whether light, a change in temperature, a combination of change in temperature and dilution of organic material by the rains, or even the presence of a complementary strain, are required to institute the formation of the perfect stage, is yet to be solved. At all events, from these collections, the indications are that the asexual method of repro-

[1] Contribution from the Cryptogamic Laboratories of Harvard University, No. 93.

duction is sufficient to perpetuate the species under tropical conditions.

In order to make a comparison with what others had found in temperate countries, the development and morphological characters of the non-sexual stage of this tropical species was studied. Gross cultures were made, but unfortunately lack of equipment for making pure cultures prevented experiments of a physiological nature to determine what might cause sexual reproduction. The development as thus worked out was found to be typically as follows. The zoöspore on being set free, swims about, later comes to rest, loses its cilia, rounds up and shortly begins to increase in size until it is approximately three times its original dimensions, and then puts out a germination tube (PLATE 21, FIG. 1–2). This tube branches (PLATE 21, FIG. 3), developing into a rhizoidal system which penetrates deeply and ramifies in the substratum, sending back a supply of food that makes possible the elongation of what was formerly the swollen zoöspore body, but which now becomes the basal cell (PLATE 21, FIG. 4). This basal cell elongates and during elongation a definite concentration of protoplasm may readily be observed at the apex from which the sporangiophores and sporangia will arise.

In the majority of cases observed the sporangiophores grow out first, elongating until three or four of the constrictions peculiar to the order are formed and then the sporangia are produced at the tip of the last segment (PLATE 21, FIG. 5*a*, *b*). But such is not always true, for occasionally one finds both sporangia and sporangiophores at the tip of the basal cell (PLATE 21, FIG. 5*c*). This latter condition suggests interesting points for consideration. The suppression of zoöspore production in the sporangia and their resulting proliferation by hyphae is not uncommonly met with in certain genera of the Saprolegniales and in the genus *Phytophthora* of the Peronosporales. Likewise, in the fungus under discussion, if a group of sporangia at the end of a sporangiophore be examined (PLATE 21, FIG. 7), there may frequently be found among them one or more sporangia that are conspicuously longer than those that have already discharged zoöspores or appear about to do so. These elongate sporangia subsequently turn out to be sporangiophore initials. In addition,

sporangia may be fully formed, only to produce, not zoöspores, but sporangiophores which grow out from the papillae (PLATE 21, FIG. 6). Since this same proliferative activity occasionally takes place at the apex of the basal cell, then the first constriction, at the basal cell, also may be considered a result of the proliferation of a potential sporangium in the manner previously described for the sporangiophores.

In the earlier stages of development, the sporangia produced are entirely of the smooth, elongate-elliptical type such as is found in the related genus, *Sapromyces*, with no ornamentation around the papilla. Later on, after the fungus has grown for some time, a second type of sporangium takes the place of the first to a considerable extent, though both kinds are occasionally found on the same plant (PLATE 21, FIG. 10). This second type resembles the smooth one, but is, on the average, larger in size. It differs also in having from four to six finger-like projections surrounding the apex of the sporangium around the already opened, or as yet still closed papilla of dehiscence (PLATE 21, FIG. 12–13). These projections give to the sporangium the general appearance of a basidium with from four to six stout sterigmata (PLATE 21, FIG. 10–11). A gross culture, made from the same material from which this specimen was taken, was grown for two weeks, but in that time not one of the spinose sporangia was produced. This would seem to indicate that the secondary form occurs only after considerable growth. Von Minden states, as a result of his culture experiments with *Araiospora spinosa*, that the spinose sporangia arise "unter ungünstigen Ernährungsbedingungen," while the smooth sporangia are produced when the plant enjoys an easily available source of nourishment. Such may be the explanation in the case of this tropical species as well. Furthermore, he believes that these spinose sporangia have a longer resting period, but the writer has no evidence either for or against this.

The further history of a primary or smooth sporangium is as follows. At about the same time that the content of the sporangium has begun to differentiate, or slightly before, a plug of modified fungus cellulose that stains more deeply wine red with zinc chloriodide than do the cell walls is laid down in the

constriction at the base of the sporangium, thus separating it from the sporangiophore. Occasionally, even when differentiation of the content of the sporangium has proceeded to a considerable degree, a minute isthmus or thread of protoplasm may be seen connecting the sporangium and the sporangiophore. In the process of differentiation of the sporangium, the protoplasmic content, viewed from the surface, breaks up into dense irregular hexagonal masses which have not as yet assumed the typical zoöspore form. Discharge takes place then through an opening made by the pushing out of a thin-walled area at the tip of the sporangium to form a papilla, the end of which is usually apparently dissolved rather than ruptured, as shown by the tapering of the wall and the relatively smooth edge at the mouth (PLATE 21, FIG. 9). Pressure from within, however, also plays an important part in the formation of the papilla and in the discharge of zoöspores if we may judge by the fact that the intervals between the escaping spores increase successively, and by the fact that in the early stages of sporangial discharge the zoöspore emerges through the papilla without the aid of cilia, as these do not develop until the zoöspore has remained at the mouth of the sporangium for a short time.

Typically the zoöspores, which may be partially delimited at the time, emerge from the sporangium surrounded by a thin membrane, the bladder mentioned by von Minden for *A. spinosa* and by Thaxter in the case of *Rhipidium americanum*. This is soon broken by the increasing number of spores that are exuded from the sporangium, and the resulting mass becomes a loosely cohering one from which the spores escape by drawing apart and rounding off. Later, however, the zoöspores emerge singly through the papilla of discharge and after a brief pause at the mouth during which there is a slow twitching movement while the spore assumes its characteristic size and shape, it swims away. On one occasion, the intervals between the spores as they escaped one at a time were measured and found to vary from four to nine seconds, the lapses becoming greater as the number of spores remaining in the sporangium decreased. Occasionally, when only a few spores are left, these mature, churn around, later come to rest, and then germinate within the sporangium, producing germ

tubes that grow out through the papilla or even through the surrounding walls.

DISTINGUISHING CHARACTERS OF THE FUNGUS

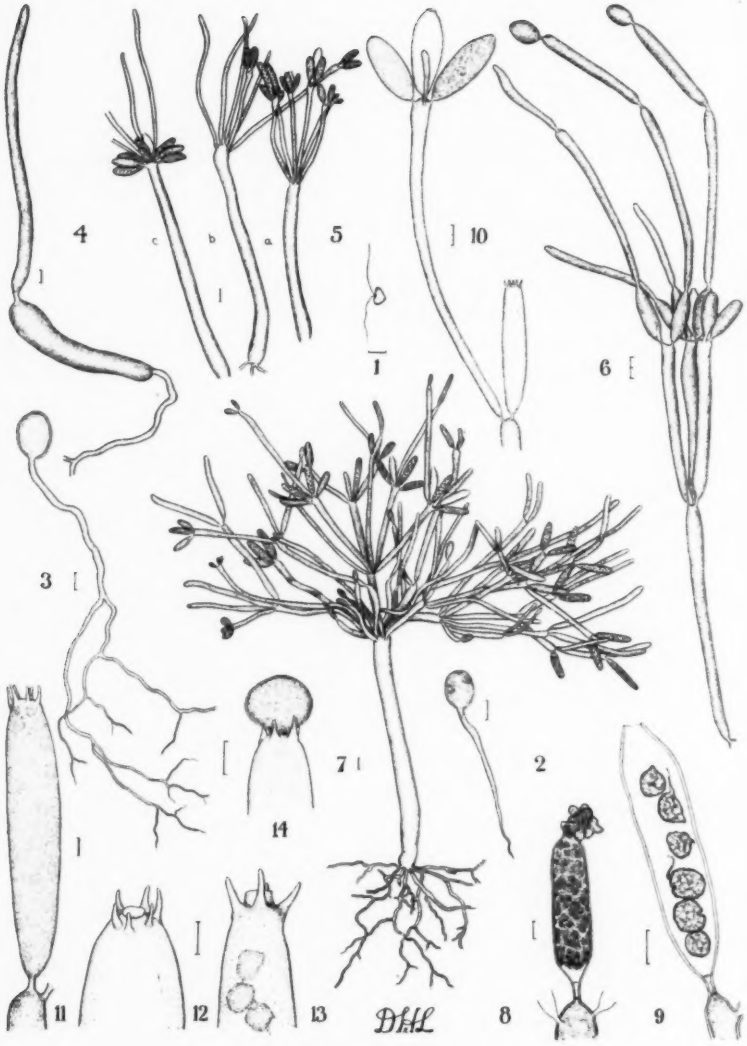
This British Guiana species of *Araiospora*, in its earlier stages, resembles rather closely *Sapromyces Reinschii* (Schröt.) Fritsch as described by Thaxter, except that the basal cell is more robust in the former. The resemblance to *Sapromyces* persists through the formation of the smooth, primary sporangia and is not lost till later in the course of development when the second type of sporangium, the spinose sporangium in the sense of Thaxter, is produced. This latter immediately sets this apart from *Sapromyces* and shows clearly that it belongs to the genus *Araiospora*. From *Araiospora pulchra* it is readily distinguished by the fact that the entire surface of the sporangium is not covered by stout radiate spines, but instead, these spines, four to six in number, are restricted to a ring around the base of the apical papilla, thus resembling more the conditions in *A. spinosa*. However, this species may easily be separated from *A. spinosa* by the short and straight or only slightly curved spines (PLATE 21, FIG. 10–13), as contrasted with the very long recurved ones of the latter. These are the outstanding characters of the British Guiana material, but in addition it differs markedly in other dimensions, as shown in the following table:

	A. pulchra	*A. spinosa*	*A. coronata*
Basal cell	1,000–1,500 × 25–50 μ	800 × 160 μ	826–846 × 45–48 μ
Smooth sporangium	120–175 × 30–35 μ	90–150 × 45–60 μ	63–85 × 11.5–16.2 μ
Spinose sporangium	45–60 × 48–70 μ	100–150 × 40–80 μ	68–130 × 12–26 μ
Spines	10–35 μ	60–70 μ	7–9 μ

Although the perfect stage is lacking, it seems quite justifiable to describe this, even on its asexual characters, as a distinct species.

Araiospora coronata n. sp.

Basal cell subcylindrical, 826–846 × 45–48 μ, with well developed branched rhizoidal system at the base, and giving rise to few or many sporangiophores at the rounded apex. Sporangiophores with constrictions and repeatedly and umbellately branched, the segments successively more elongate and slender. Zoösporangia elongate-elliptical to subcylindrical, occurring singly or in whorls of two to six, terminating the branches or at



ARAIOSPORA CORONATA

the distal ends of the segments which make up the branches. Sporangia of two types: simple sporangia smooth, 63–85 × 11.5–16.2 μ; spinose sporangia with 4–6 short (7–9 μ), straight or slightly curved finger-like spines in a circle around the apical papilla of discharge, 68–130 × 12–26 μ. The entire plant 5 mm. in length. Oöspores not observed.

Growing on submerged fruit and twigs, British Guiana, South America.

Type material in the Farlow Herbarium and the herbarium of the writer, No. *258*.

In conclusion, the writer wishes to express his indebtedness to Dr. Roland Thaxter and Professor William H. Weston, Jr., for advice and criticism, and to Mr. L. D. Cleare, Jr., Government Entomologist of British Guiana, for the many courtesies extended during and after the writer's stay in that country.

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EXPLANATION OF PLATE 21

All drawings were made from material mounted in glycerine and eosine, with the exception of figures 1, 2, 6, and 8, which are from living material, and were drawn by the aid of a camera lucida. Each division of the scale or the whole scale, if undivided, equals 10 μ.

Fig. 1. A typical biciliate zoöspore. × 260.

Fig. 2–3. A swollen zoöspore body which has given rise to a germ tube that later becomes a branched rhizoidal system as shown in fig. 3. × 260.

Fig. 4. A more advanced stage showing the basal cell derived from the swollen zoöspore body by enlargement and elongation. At the apex of the cell is produced a single sporangiophore that is followed later by several more, or by sporangia. × 180.

Fig. 5*a–c*. A group of young plants bearing sporangia. The plant on the left (5*c*) shows sporangia being borne directly on the basal cell. It should be noted that all the sporangiophores and sporangia have the same constriction at the base, thus indicating the proliferative process that is more obviously illustrated in the following figure. × 36.

Fig. 6. A terminal branch of a much elongated plant. The sporangia have proceeded rather far before environmental conditions checked zoöspore

differentiation and caused the formation of sporangiophores instead. When this differentiation has taken place to a lesser extent, the hyphae do not have the swollen base or the constriction that indicates the previous presence of a potential sporangium. Among the proliferated sporangia may be seen one that has discharged its spores. × 150.

Fig. 7. A young plant, one and one half weeks old, showing the exclusive production of the smooth or primary type of sporangia and the successive putting forth of sporangiophores from the apex of the basal cell. The rhizoidal system and also the repeatedly umbellately branching sporangiophores are clearly indicated. × 36.

Fig. 8. An enlarged mature sporangium with contents differentiated, emitting zoöspores as a loosely cohering mass. × 260.

Fig. 9. A much enlarged smooth sporangium containing a few remaining spores that have not as yet become entirely differentiated into active motile zoöspores. The modified fungus cellulose plug that is formed in the constriction at the base of the sporangium, in the early stages of the breaking up of the content of the sporangium into hexagonal masses, may be seen surmounted by a button-like mass of similar material. Also, the tapering of the walls around the mouth of the papilla of discharge may be observed. × 500.

Fig. 10. A terminal portion of a conidiophore showing the smooth and the spinose types of sporangia. It should be noted that one sporangium of each type has already discharged its spores, thus leaving no doubt as to the maturity of the sporangia. × 180.

Fig. 11. The spinose type of sporangium, more highly magnified, with its differentiated protoplasmic content, showing the arrangement of the spines around the apex before the formation of the papilla of discharge. × 260.

Fig. 12–13. Greater magnifications of the terminal portions of the sporangia to illustrate the arrangement of the six, and also the four, spines around the discharge papilla. × 500.

Fig. 14. An early stage in the escape of zoöspores. Here the spores may be seen, as yet not entirely delimited, surrounded by a thin membrane, the vesicle in the sense of von Minden. This condition precedes that illustrated in figure 8. × 500.

MYCOLOGICAL NOTES FOR 1925 [1]

L. O. Overholts

(With Plate 22 and 1 Text Figure)

1. Gloeosporium quercinum West.

In collecting class material of a *Phyllosticta* on *Castanea* this fall I found two leaves with one or two spots about 1 cm. in diameter, and bearing numerous hypophyllous acervuli of a *Gloeosporium*. Not finding a *Gloeosporium* listed on *Castanea* I sent one of the leaves to Prof. Dearness who writes that the fungus cannot be distinguished from *G. quercinum* West. as determined by J. B. Ellis. The description in Saccardo (**3**: 714) records the spores as 5–6 × 2.5 μ. My measurements are 6–7 × 2 μ. If the fungus is correctly referred to this species, *Castanea* is, I think, an unreported host. On *Quercus* it is certainly uncommon in Pennsylvania, since several years of rather intensive collecting have failed to reveal its presence.

2. Cercospora Maianthemi Fuckel.

This uncommon species on *Maianthemum canadensis* was collected at Trout Run, Lycoming Co., Pa., in June of this year. The hypophyllous tufts of conidiophores, arising from a distinct subepidermal plectenchymous mass, are easily visible to the unaided eye. The spores are 4- to 10-celled at maturity and measure 50–110 × 5–6 μ. They are practically colorless or slightly smoky under the microscope.

3. Phlyctaena septorioides Sacc.

The following notes were made from specimens collected at State College, in February, 1925, on stems of *Phytolacca decandra*, and identified by Professor Dearness.

[1] Contribution from the Department of Botany, The Pennsylvania State College, No. 54. Published by permission of the Director of the Agricultural Experiment Station, as Technical Paper No. 408.

Caulicolous on extensive whitened areas several centimeters in extent; pycnidia thickly scattered, erumpent and appearing more or less superficial, black, elliptic to subcircular, $^1/_5$ to $^1/_3$ mm. in length, opening at maturity by a fissure; spores linear, curved, hyaline, one-celled, 15–21 × 0.5–1 μ.

4. DISCOSIA ARTOCREAS (Tode) Fr.

Though reported on a wide range of host plants, and even on cones of *Pinus* sp. by Saccardo, I find no definite record of its occurrence on cones of *Pinus Strobus*. It was collected in Stone Valley, Huntingdon Co., Pa., in May, 1925, on an immature cone lying on the ground. Search for other cones and an examination of normal mature cones failed to show its presence. It seems to me that the spores are very slightly fuscous as seen in mass under the microscope.

5. GONATOBOTRYUM MACULICOLA (Wint.) Sacc.

Gonatobotryum is a peculiar and little known genus of imperfect fungi of the family Dematiaceae, with the conidia borne in groups in swollen node-like areas of an erect conidiophore as seen in the accompanying illustration (TEXT FIG. 1*A*). The species was well described by Winter in 1883 in Hedwigia, from Pennsylvania collections by Rau. Though I have collected it for several years, this is the first season I have had satisfactory sporulating material. Apparently the spores are produced early in the season, a collection made at Charter Oak, June 24, being in excellent condition. The spores are soon shed and later in the season the fungus is not in condition for satisfactory determination, though the conspicuous conidiophores persist. Later I find a *Phyllosticta* inhabiting the spots with the *Gonatobotryum*. The following notes were made from the Charter Oak collection:

Spots circular, 1–4 mm. in diameter, or by confluence larger and more irregular, red brown with a slightly darker margin; conidiophores amphigenous, erect, dark brown and hair-like, 180–400 μ high, 15–18 μ thick at the base, 8–12 μ at the apex, septate, with one or two slightly inflated nodes that are conidia-bearing; conidia on very short stalks that give an echinulate appearance to the nodes after the spores are shed, soon deciduous, the spores

many at each node, pale brownish, ovoid or narrow fusoid, smooth, 6–12 × 3.5–4 μ.

On leaves of *Hamamelis virginiana*. Common.

6. CRUMENULA on *Pinus pungens* and *P. rigida*.

On May 8, 1925, the writer discovered at Greenwood Furnace, Huntingdon Co., Pa., evidence of rather extensive twig injury on *Pinus pungens* by a species of *Crumenula* that appears to be close to if not identical with *C. pinicola* (Rebent.) Karst. The injury is confined to the terminal twigs of the lateral branches and involves the twig growth for the last 6 years or less (PLATE 22, FIG. 1). The fungus fruiting bodies are on definite though not conspicuous cankered areas, over which the diameter of the stem has increased to a noticeable extent until it has become somewhat fusiform (PLATE 22, FIG. 2). Only a few of the small black apothecia are produced on each canker or swelling (PLATE 22, FIG. 3). They measure 1 to 3 mm. in diameter and are entirely black in color. In every case the twig is killed distally to these cankered areas. The general appearance of the disease and the nature of the cankers and the fruiting bodies is brought out in the accompanying illustrations. Other pines, including *P. virginiana*, *P. rigida*, and *P. Strobus*, though growing indiscriminately mixed with *P. pungens* were not attacked. The attacked trees are probably 15 to 20 years of age and are growing in situations well suited to that species.

The same fungus had previously been found in November, 1921, on *Pinus rigida* at a locality about six miles from the 1925 collection. Here also definite injury was present as evidenced by the dead terminal twigs and the definite cankers that exuded considerable resin. On this occasion it was found on but one tree, nearby trees of the same species and of *Pinus Strobus* being uninfected. Attempts to obtain a specific determination were not successful on that occasion.

The plant is easily recognized by the fact that when the apothecia are crushed in KOH the entire mount quickly becomes a conspicuous greenish blue color and the asci become greenish blue under the microscope. The spores, according to Rabenhorst, are "meist einzellig," and in the 1921 collection only one-celled

spores were seen. In the later collection, however, some two-celled spores are present. They are very narrow-fusoid or

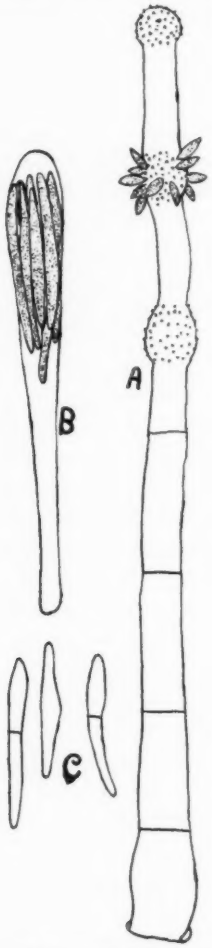


FIG. 1. A, Conidiophore of *Gonatobotryum* showing nodes with spores and short sterigmata. B–C, *Crumenula pinicola*, ascus and mature spores.

narrow-clavate and measure 27–28 × 2.5–4 μ (TEXT FIG. 1*B*, *C*). The paraphyses are dichotomously forked at the tip. Super-

ficially the apothecia are almost exact counterparts of those of *Cenangium Abietis*, which however has very different spores and does not develop the characteristic color of the plants here under discussion.

7. MELAMPSORA BIGELOWII Thuem. on *Salix* stems.

Melampsora Bigelowii was first observed on the woody stems of *Salix* at Greenwood Furnace, Pa., in the spring of 1920. A few years previous a small willow holt had been established there, the species used being apparently *Salix pentandra* or *S. purpurea*. Since Bethel's discovery of *M. Bigelowii* perennating on the woody stems of *Salix* the writer had been watching for this phenomenon in the east. The Greenwood Furnace location was known to be many miles from any native or planted *Larix* that would harbor the aecial stage, yet the uredinial and telial stages occurred every year on the leaves of the *Salix*. The first collections of the uredinial stage on the wood were on one-year-old stems and were found in the spring of the year when the willows were being harvested. Since 1920 these willows have not been cut, and now are 8 to 9 feet tall and 5 years of age. In May, 1925, the rust was again found to be fairly common in the holt, fruiting now exclusively on wood that is three, four, and five years old. Some cankers on each of these age classes fruited this year for the first time (PLATE 22, FIG. 4). Others are fruiting for the second time (PLATE 22, FIG. 5), but none could be found on which the rust was perennating to a greater extent. Either the mycelium actively invades the cambium and phloem cells, causing their death, or else the bursting of the bark by the uredinial pustules causes these tissues to dry out and die. The latter situation would in itself undoubtedly be sufficient cause of the death of these cells. Whatever may be the case, conspicuous cankers are formed, as shown in the illustration, and many of the stems are killed. In some of these the fungus seems to last only a single season, at least many two-year-old cankers are not fruiting this year, though the stem is yet alive. In others the fungus seems to persist in the same canker, providing of course that the tree does not die.

This year a series of these cankers have been tagged and will

be kept under observation in order to determine how long the fungus persists in the wood.

8. PUCCINIA TENUIS Schw.

The only Pennsylvania collection of this rust noted is the type collection from Bethlehem, Pa. It was collected this year at Trout Run, Pa., on *Eupatorium urticaefolium*, its only recorded host, by Overholts and Denniston in June. Spores 13–16 × 12–15 μ. The species is distinguished from *P. Eleocharidis* Arth. in its aecial stage by the much smaller spores and by the fact that up to the present time the latter species has not been recorded on *E. urticaefolium*, though on several other species of the genus.

9. WITCHES BROOM on *Quercus Prinus*.

At Bear Meadows, Center Co., Pa., a witches broom was found in the top of a tree of *Quercus Prinus* about twenty-five feet tall. This is the first time a witches broom has been found on this genus of trees in Pennsylvania. The specimen was collected in February when it was impossible to verify the presence of a leaf fungus such as a *Taphrina* or an *Exoascus*. Search of the literature shows *Taphrina Kruchii* Vuill. to be recorded as causing brooms on this host, but the causal agent in this case cannot be determined at this time.

EXPLANATION OF PLATE 22

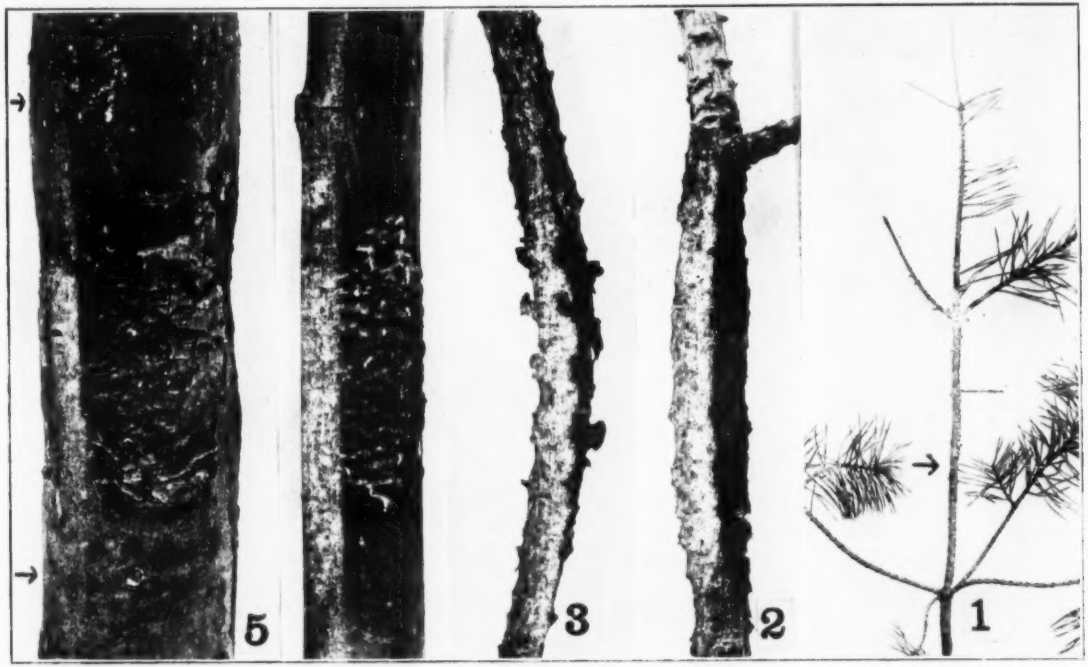
Fig. 1. Terminal branch of *Pinus pungens* showing effect of *Crumenula*. Canker and apothecium near the arrow. × 1. Overholts Herb. No. 9733.

Fig. 2. Fusiform canker on *Pinus pungens*, caused by *Crumenula*. Slightly enlarged.

Fig. 3. Cankered area bearing the black apothecia of *Crumenula*. Slightly enlarged. No. 9733.

Fig. 4. Stem of *Salix* with *Melampsora Bigelowii* in fruit for the first time. × 1. Overholts Herb. No. 9729.

Fig. 5. Living stem of *Salix* with *Melampsora* canker that fruited abundantly in 1924 but is fruiting only sparingly in 1925, both above and below the area of last year's fruiting and opposite the arrows. × 1. Overholts Herbarium No. 9729.



1–3. CRUMENULA ON PINUS PUNGENS
4–5. MELAMPSORA ON SALIX

BANANA FRECKLE AND LEAF SPOT

O. A. Reinking

After a careful examination made in Hawaii and the Philippine Islands, the banana freckle or black spot disease as described by Carpenter (**8**) from Hawaii has been determined to be caused by the same fungus producing a disease called leaf spot of banana (**6**) (**7**) in the Philippine Islands. At the time that the leaf spot disease was described in the Philippines no report of the fungus on the fruit was made. Lee (**9**) some years later reported the presence of banana freckle on the fruit in the Philippine Islands and reported the disease to be the same as that found in Hawaii. No reference was made to the similarity of the organisms causing the leaf spot and the fruit spotting. The recent investigation indicates that the two diseases are the same and similar to the banana freckle described by Carpenter as occurring in Hawaii and therefore are caused by the same fungus, *Macrophoma musae* (Cooke) Berl. & Vogl. A literature review of the organism in question may also clarify an apparent mistake in nomenclature.

In 1884, Saccardo (**1**) described a fungus on plantains as follows under the name of *Phoma Musae* (Cooke) Sacc.

593. *Phoma Musae* (Cooke) Sacc. *Sphaeropsis? Musarum* Cooke in Grevillea.

Peritheciis semiimmersis, atris, nitidis, subconicis, in maculis parvulis congestis; sporulis subglobosis vel ovatis vel ellipticis, hyalinis, 12–22 = 10–14, basidiis nullis visis.

Hab. in *Musa paradisiaca*, Belgaum in India orientali.

The fungus was then, in 1886, redescribed by Berlese and Voglino (**2**) as *Macrophoma Musae* (Cooke) Berl. & Vogl. In 1892, it was so listed by Saccardo (**3**). In 1913, Sydow (**4**) enumerated the fungus *Macrophoma Musae* (Cooke) Berl. & Vogl. after having examined infected material of banana and plantain from the Philippine Islands.

Spore measurements made of the fungus from the leaf in the Philippines compare favorably to the fungus described by Carpenter in Hawaii. The following measurements were found

for the conidia: 8.5–20 × 6.75–11.75 μ. The fungus also compared favorably in all other respects as described by Carpenter (**8**) and Berlese and Voglino (**2**). The two fungi, therefore, may be regarded as the same. Since the name *Phoma Musae* had already been used for a species of fungus on *Musa* and later this same organism was redescribed as *Macrophoma Musae*, and because the fungus causing the leaf spot and freckle of banana in the Philippine Islands compares favorably with the organism described as producing banana freckle or black spot disease in Hawaii, it is suggested that Carpenter's *Phoma Musae* be reduced to a synonym of *Macrophoma Musae* (Cooke) Berl. & Vogl. The disease known as banana freckle and black spot will then have to be designated as being caused by *Macrophoma Musae* (Cooke) Berl. & Vogl.

While conducting the investigation in Hawaii it was observed that the Gros Michel banana of Central America was apparently resistant to the disease. No infection was noted on this variety even when growing adjacent to heavily infested bananas of the Chinese Dwarf variety. A large number of varieties in the Philippines are infected. The socalled red variety of Saba (Sabang Pula) in the Philippines is severely affected on leaf and fruit.

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ELLSWORTH BETHEL

ELLSWORTH BETHEL

(With Portrait, Plate 23)

We here present a recent photograph of the late Ellsworth Bethel, whose unexpected death was noted in an earlier number of Mycologia. Although not exclusively a mycologist he was sufficiently prominent in this field to deserve more than a passing mention. Born in Ohio, June 20, 1863, he migrated to Colorado in 1890, where he soon attained prominence as a teacher and an all-around naturalist. He was a graduate of Scio College and of the East Tennessee Wesleyan University, and in 1905 he received an honorary degeee of M.A. from the University of Denver.

My own personal acquaintance with Mr. Bethel is almost coextensive, in point of time, with my interest in mycology. From about 1904 until the day of his death (September 8, 1925) we were rather closely associated in things mycological and it is difficult to go far in the herbarium without encountering fungi collected in Colorado by Bethel.

When I first visited Colorado in 1910, Mr. Bethel's company on a number of trips into the mountains was a great help and inspiration. Several days were spent together at Tolland; also in Geneva Creek Canyon and in the vicinity of Boulder. On all of these occasions he seemed to have unlimited physical energy and boundless enthusiasm for the work. He was an omnivorous collector.

While the number of mycological titles accredited to him is surprisingly small, his collections have furnished the groundwork for a number of articles contributed by other mycologists. In "The Myxomycetes of Colorado. II."[1] Dr. W. C. Sturgis states: "Up to 1907 I had the invaluable assistance of Mr. Bethel, of Denver, an able and tireless collector, thoroughly acquainted with all parts of Colorado." Of the 94 species of slime-moulds reported from Colorado in the first paper by Dr. Sturgis a very large per cent represented the results of the field

[1] Colorado Coll. Pub. Sci. Ser. **12**: 452. 1913.

work of Mr. Bethel in this particular group. One species of slime-mould, *Physarum Bethelii* (Macbr.) Lister, has been dedicated to him and a fine colored illustration published by Miss Lister, the English authority on the slime-moulds.

He was especially interested in plant rusts, beginning their collection shortly after going to Colorado, and here again contributed much field information for other workers as well as several articles on his own account. One species, *Gymnosporangium Betheli* (*Roestelia Betheli* Kern), has been dedicated to him by Dr. F. D. Kern now of the Pennsylvania State College. Also *Aecidium Betheli* and *Uromyces Betheli* by Dr. J. C. Arthur and *Peridermium Betheli* by G. G. Hedgcock and W. H. Long, the latter species now regarded as a synonym of *Cronartium Comandrae*.

And in other fields of mycology he showed similar interest. Many interesting specimens of discomycetes have been sent to us in the course of the years. One cup-fungus, *Godronia Betheli*, named for him by the writer, was found to have an earlier name so must be relegated to synonymy.

In 1917 he began work for the United States Department of Agriculture in the office of Forest Pathology and was connected with this office until the time of his death. On October 3, 1924, he married Miss Dorothy S. Stokley of Philadelphia.

He has been a subscriber to MYCOLOGIA and loyal supporter of this periodical from its earliest inception. His loss will be keenly felt by mycologists.

FRED J. SEAVER

NOTES AND BRIEF ARTICLES

Dr. L. O. Overholts, of State College, Pa., would like to hear from anyone who has successfully worked out a scheme for drying fleshy fungi collected on long auto trips, where only overnight stops are made. Description of any method of utilizing the heat of the engine or of constructing some sort of drier that can be safely used in transit would be much appreciated.

Dr. C. J. Humphrey, for many years in charge of the forest pathology investigations at the Forest Products Laboratory, U. S. Forest Service, Madison, Wisconsin, and Lecturer in Forest Pathology at the University of Wisconsin, has resigned from the Department of Agriculture to accept the position of Mycologist, Bureau of Science, Manila, Philippine Islands, where he will direct the research work of the Bureau in mycology and plant pathology. He sailed from San Francisco on May 29 to assume his new duties.

The *National Geographic Magazine* for April, 1926, contains (421–443) an article by William Crowder entitled "Marvels of Mycetozoa" with the subtitle, "Exploration of a Long Island swamp reveals some of the secrets of the Slime Molds, dwelling on the borderland between the plant and animal kingdoms." This is a very interesting popular account of the life history of the Slime-Molds. The article is illustrated by photographs and 16 beautifully colored plates. The author is to be congratulated on his efforts to popularize an obscure corner of the plant world.

Dr. Frank D. Kern, of The Pennsylvania State College, and Mr. R. A. Toro, of the Insular Experiment Station of Porto Rico, spent the month of March in mycological investigations in Santo Domingo. The trip was made under the auspices of the University of Porto Rico and the Insular Department of Agriculture.

Dr. R. Ciferri, director of the Agronomy Experiment Station, Jaina, coöperated very effectively. Especial attention was given to the collection of Uredinales and Pyrenomycetes. About 400 collections were made. The season was not favorable for collecting owing to the dry conditions which prevailed and the consequent scarcity of foliage. These collectors report that they regard this as a preliminary trip which is to be followed later by a more extensive exploration.

Professor H. H. Whetzel visited the University of Florida from April 5th to April 8th on invitation of the president, Dr. Murphry. He delivered two addresses: one, on the subject of "The Relation of Teaching and Research" before the faculty, and another on "The Place of Science in a Modern College Man's Education" before the student body. A special collecting trip to one of the collecting grounds near Gainesville was put on by the members of the staff of the Department of Plant Pathology of the Experiment Station. Professor Whetzel was entertained at the home of Dr. Burger, head of the Department of Plant Pathology of the Experiment Station. Provisional plans were made for a co-operative fungous survey of Florida in the near future.

Investigations into the phenomena of sex in fungi—mushrooms and toadstools—carried on at the University of Manitoba by research students working under the direction of Dr. A. H. R. Buller has attracted the attention of the Dominion of Canada Research Council and the work is being officially recognized by that body. These workers—Misses Irene Mounce and Dorothy Newton and Mr. W. F. Hanna—have found evidence that a sexual process is initiated in the mycelium of mushrooms and toadstools before the fruit-bodies are started. Experiments made with species of *Coprinus* have led Dr. Buller and these workers to believe that in some of the species there are no less than four distinct sexes. The first experiments on sex in mushrooms and toadstools were made in 1918 by Mlle. Bensaude, a French lady. Thus far the only literature on this subject in English has been published from the University of Manitoba. JOHN DEARNESS

THE ASPERGILLI

An important new book has just appeared under the title "The Aspergilli" by Charles Thom and Margaret B. Church, of the Microbiological Laboratory of the Bureau of Chemistry, Department of Agriculture. This book consisting of 272 pages and a number of text figures represents the results of more than twenty years of study on the part of the senior author. The study was undertaken in connection with the economic phases of the question, especially the relation of these fungi to the decay of vegetables and fruits. The difficulties encountered in the determination of species have prompted the writers to put their work into such form that it may be used by subsequent workers.

Part I of this work comprising 90 pages is devoted to the history, the morphology, and the economic aspects of the problem. Part II consists of a taxonomic study with elaborate keys which are expected to enable the worker to identify his plant with a reasonable degree of certainty. Among the economic considerations, one of the interesting chapters is that devoted to the diseases of the animal body. Numerous reports of disease of the human body cite *Aspergilli* as the cause of characteristic lesions. The book appears to be very well arranged and will doubtless be a valuable asset to every mycological library.

FRED J. SEAVER